Department of Energy

Idaho Operations Office
785 DOE Place
Idaho Falls, Idaho 83402

December 3, 1990

Mr. Michael Gearheard, Chief
Waste Management Branch
U. S. Environmental Protection Agency
Region 10
1200 Sixth Avenue
Seattle, WA 98101

SUBJECT: Final Closure Report for CPP-55, Mercury Contaminated Area

Dear Mr. Gearheard:

This correspondence forwards the Final Closure Report for COCA unit CPP-55, Mercury Contaminated Area, to your office for review and approval. The Closure Plan for this site was submitted on January 27, 1989. The plan was jointly approved by the state of Idaho and EPA Region 10 on September 19, 1989. The letter of approval indicated that, "INEL may proceed with implementation of closure activities per the Closure Plan submitted 1/27/89." These closure activities included site characterization necessary to determine the amount of contaminated material to be removed.

This report evaluates the results of closure activities completed at the site, identifies the absence of RCRA hazardous constituents, and recommends that the unit be clean closed under RCRA with no waste removal necessary. The report concludes that this unit poses no risk to human health or the environment. Therefore, no further action at this site is recommended.

If you have any questions, please contact W. N. Sato at (208) 526-0193 or L. A. Green at (208) 526-0417.

Sincerely,

J. Solecki

J. E. Solecki, Acting Assistant Manager
Environmental Restoration and
Waste Management

Enclosure

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November 21, 1990

FINAL REPORT FOR CLOSURE OF CPP-55, MERCURY CONTAMINATED AREA (SOUTH OF ICPP T-15)

CONTENTS

FINAL REPORT FOR CLOSURE OF CPP-55, MERCURY CONTAMINATED AREA (South of ICPP T-15)

LIST OF FIGURES

LIST OF TABLES

EXECUTIVE SUMMARY

Land Disposal Unit (LDU) CPP-55 was characterized during the winter of 1989-1990, in accordance with the requirements of the INEL Consent Order and Compliance Agreement (COCA) and as outlined in the closure plan approved September 1989, to determine the nature and extent of any contamination at the unit. The results of this characterization work were then reviewed by the sampling subcontractor (Golder Associates, Inc.) and WINCO Environmental Restoration and used to determine the specific requirements for unit closure under RCRA (40 CFR 265, Subpart G).

LDU CPP-55 is located inside the Idaho Chemical Processing Plant (ICPP) security fence adjacent to the south side of building T-15 and covers an area of approximately 4,000 ft^2. During an environmental study of controlled pollutants at the ICPP in 1984, non-plant subcontractors were observed discarding paint solvents, used during cleanup operations, to the soil adjacent to building CPP T-15. It is believed that paint solvents were also discarded to the soil in this area on other occasions. WINCO assumes that the disposal practice began soon after the building was occupied in 1982, and that the practice occurred sporadically until 1984.

Drilling to six feet at ten locations was conducted between December 19, 1989 and January 5, 1990. The drilling operations for the deep borehole to a depth of 123 feet, were conducted from February 6 to February 22, 1990. Five inorganic hazardous constituents (arsenic, chromium, lead, silver, and mercury) were detected above background levels. Mercury was the only constituent detected in more than two samples, but nowhere exceeded the EP-Toxicity limit of 0.2 mg/L. Organic analysis identified three common laboratory contaminants (toluene, 4-methyl 2-pentanone, and bis (2-ethylhexyl) phthalate) each in two separate samples. These were removed from further consideration by validation procedures. Again, none of these were above regulatory or health based levels.

The five inorganic constituents detected were each subjected to a Health and Environmental Assessment, as recommended in the RCRA Facility Investigation Guidance. The results of this assessment (see Appendix A) indicate that the hazardous constituents present at LDU CPP-55 do not pose an unacceptable risk to human health, safety, or the environment. Results showed that the highest non-cancer risk factor to be from ingestion of chromium contaminated soil (at 1.3×10^{-5} for a residential adult scenario). Risk associated with the most wide spread contaminant found, mercury, is at the 1.0×10^{-6} level for the same scenario. The cancer risk factor for all exposure scenarios was found to be in the 1×10^{-6} level.

In conclusion, all RCRA hazardous constituents detected at LDU CPP-55 were present below regulatory limits and can be shown not to pose any potential threat to human health, safety, or the environment. For these reasons there does not appear to be any basis for remediation or post-closure activities at this site. RCRA requirements under 40 CFR 265, Subpart G address only those sites with hazardous waste present. Since no RCRA wastes are present above regulatory limits, it is being recommended that LDU CPP-55 be clean closed

without removal actions. If any future activity is deemed necessary, under the upcoming INEL Interagency Agreement, it will be completed at that time under that agreement.

FINAL REPORT FOR CLOSURE OF CPP-55, MERCURY CONTAMINATED AREA (South of ICPP T-15)

EPA Facility ID No.: ID 4890008952

Owner/Operator: Dept. of Energy, Idaho Operations Office
Address: 785 DOE Place
Idaho Falls, Idaho 83402
(208) 526-1505

Facility Address: Idaho Chemical Processing Plant
Scoville, Idaho

1. FACILITY CONDITIONS

1.1 General Description

The mercury contaminated area designated as Land Disposal Unit (LDU) CPP-55 is located inside the Idaho Chemical Processing Plant (ICPP) security fence south of temporary building ICPP T-15 (N 695,087; E,297,607) (see Figures 1, 2 and 3). As stated in the approved closure plan (WINCO, 1989), the area designated as LDU CPP-55 was located as a result of an environmental study of controlled pollutants at the ICPP in 1984. At that time, a non-plant subcontractor was observed discarding paint solvents to the soil adjacent to building CPP T-15. WINCO assumes that the disposal practice began soon after the building was occupied in 1982, and that the practice occurred sporadically until being discovered and prohibited in 1984. LDU CPP-55 is adjacent to the south side of building T-15, where doors are present, and covers an area of approximately 4,000 ft^2 (see Figure 2).

Since there are no records of the incidents, beyond the single citing, and the materials did not visibly stain the soil, the area established

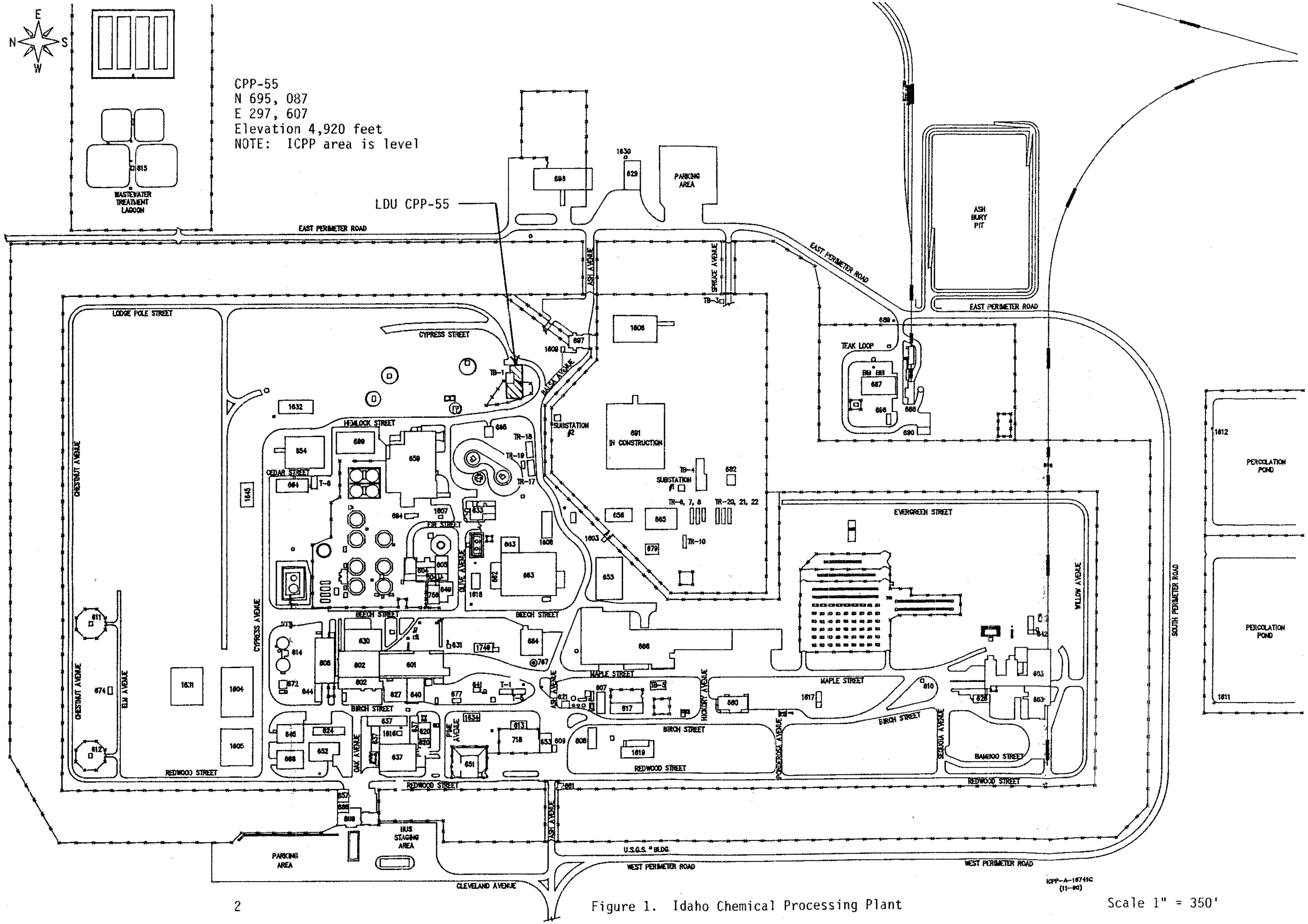


Figure 1. Idaho Chemical Processing Plant

Scale 1" = 350'

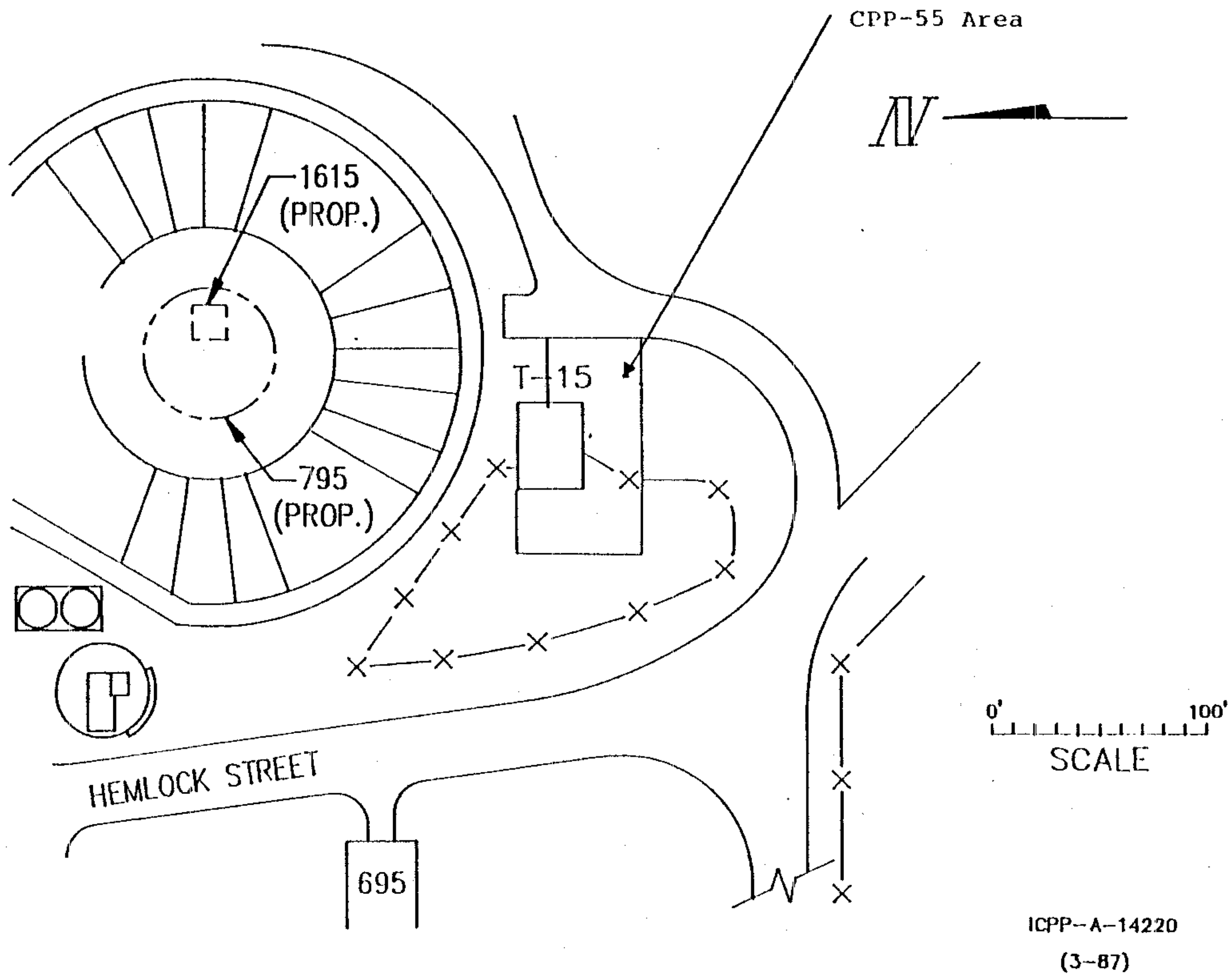


Figure 2. CPP-55 Location Map

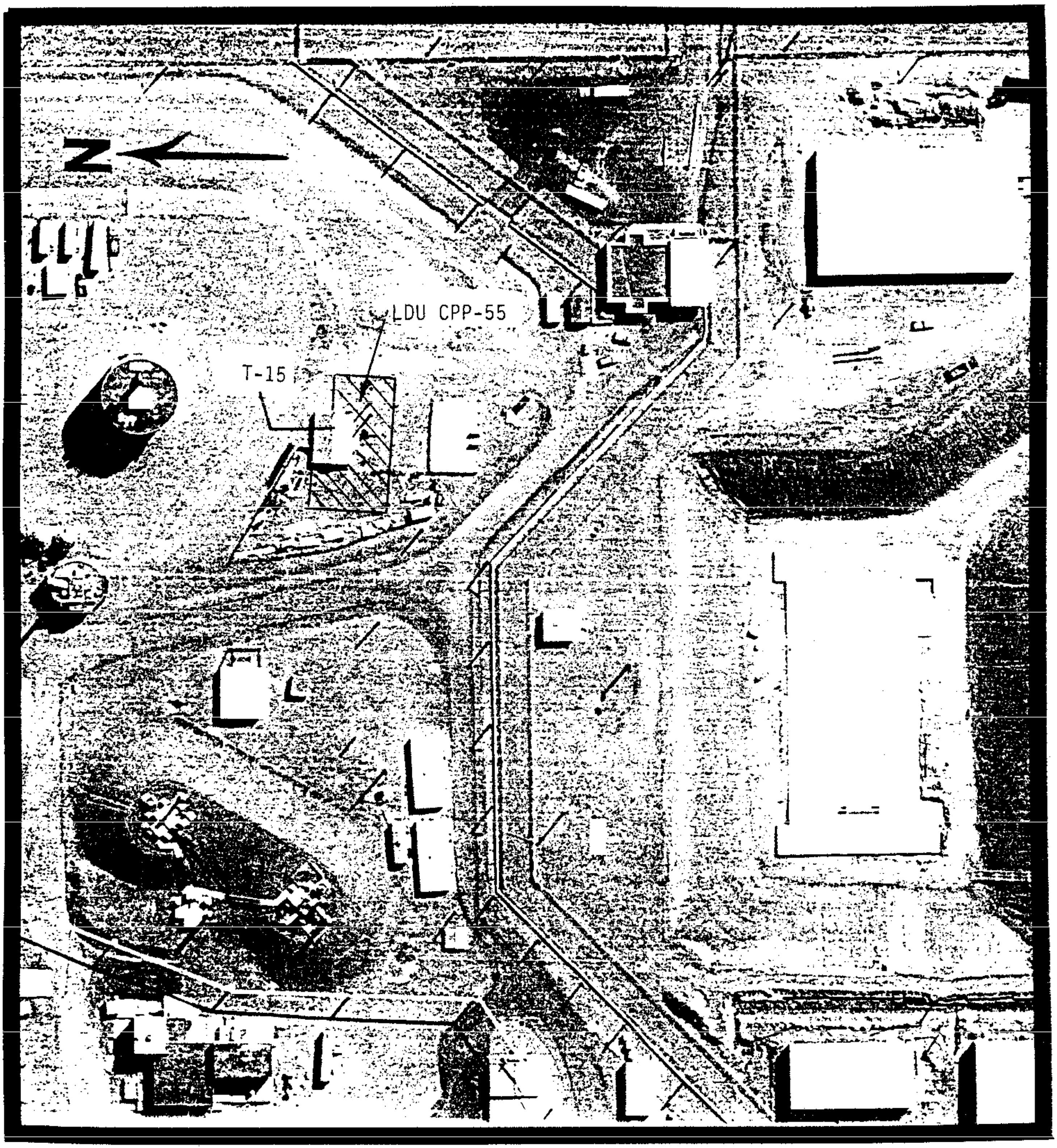


Figure 3. Photo location of CPP-55.

for the unit covers most of the ground between T-15 and the surrounding roadway (see Figure 2). The exact volume of paint solvents discarded to the soil is unknown, but WINCO believes the volume is small (< 1 gal/occurrence). This belief is based on the activity observed and the knowledge that cleaning paint brushes utilizes small quantities of solvents. The area is currently being used for storage of construction materials.

Seven soil samples analyzed during an unrelated study in August 1985, for mercury and cadmium showed mercury levels ranging from 48 to 236 parts per billion (ppb). The EP-Toxicity limit for mercury is 200 ppb. On the basis of one sample, at 236 ppb, exceeding the EPA limit this unit was classified as an LDU. It should be noted that non-EPA methods were used that were more rigorous and therefore led to more conservative values. As is discussed below, this is borne out by these most recent analysis results. Since heavy metals are a constituent of some paint pigments, it is believed that the relatively high concentrations of mercury at the unit were a result of the former waste paint and solvent discarding practice. There are no processing or storage facilities, other than T-15, in the immediate vicinity of the unit from which contamination could have been contributed.

1.2 Unit Characterization Objectives

Land Disposal Unit CPP-55 was characterized in accordance with the Idaho National Engineering Laboratory (INEL) Consent Order and Compliance Agreement (COCA) and the approved closure plan. Objectives were to determine if any RCRA hazardous wastes or constituents associated with the disposal practice were present in the soil and, if so, to determine the nature and extent of any such contamination. This information will be utilized to evaluate the closure options for the unit as discussed below.

1.3 Closure Goals

DOE's closure goals, based on the characterization results described herein, are to:

- Eliminate this unit from further consideration under the COCA, since no RCRA hazardous waste or constituents were detected above regulatory limits, and those detected do not pose a risk to human health or the environment.
- Consider the unit clean closed without removal.
- Meet the commitments of the closure plan submitted in January 1989 and approved in September 1989.

2. GEOLOGY

The following is presented as additional information to that supplied in the approved closure plan of September 1989. This material is related more specifically to the ICPP than that presented earlier.

2.1 General Geology

Surfical sediments at the ICPP, and much of the INEL, consists of deposits of well graded gravels, sands, and intermittent silt, and sandy clay lenses. Surface alluvium extends to the top of the basalt, generally around 35 to 50 feet. In many areas around the ICPP there exist a layer of fine grained sandy clay and clayey or silty sand at the basalt/surface sediment interface. This layer ranges from 0 to 10 feet thick. Hydraulic conductivity of this fine grained material ranges from 1×10^{-6} to 3×10^{-2} cm/sec. Hydraulic conductivity of the coarser surface material ranges from 3×10^{-3} to 2×10^{-1} cm/sec (Cooper, 1988).

The subsurface stratigraphy of the Eastern Snake River Plain (ESRP) consists of thin (averaging <25 feet) basaltic lava flows with numerous interbedded sediments and cinder zones. The sediments are of lacustrine, eolian, and fluvial origins with source areas in the neighboring mountain ranges. These sediments also occur as fracture fillings in the basalt flows. Composition of the flows are mainly a very dark gray to black, variably vesicular, olivine basalt. Exact composition of the interbeds in the area of the ICPP is yet to be determined. However, they can reasonable be expected to be similar to the current surface sediments. This sequence of flows and interbeds extends for a depth of 2000 to 3000 feet (Doherty, et.al., 1979).

Underlying these basalt flows is a thick (5000 feet) sequence of welded rhyolite tuffs. Interbedded within these welded tuffs are layers of tuffaceous sands, air-fall ash, and ash flow tuffs (Doherty, et.al., 1979).

The deepest rocks encountered at the INEL are a dense, hydrothermally altered, recrystallized, aphanitic, rhyodacite porphyry. This unit extends from approximately 8100 feet to below 10,300 feet (Doherty, et.al., 1979).

2.2 Site Specific Geology

Surface soils at LDU CPP-55 were disturbed prior to disposal activities to variable depths estimated at 4 to 8 feet below ground. Shallow soil samples taken within this zone consisted of unstratified, dense to very dense, coarse sand and fine to coarse gravel with (<12%) silt. Gravels are well rounded, while the sand grains are sub-angular to sub-rounded. Below this zone of disturbed soils dense to very dense material, of similar composition, extends to 40.3 feet. Generally, resistance to drilling increased when natural alluvium was encountered. The interval from 40.3 feet to the top of the basalt (43.7 feet) consisted of a firm to soft, damp to moist, silt to clayey silt layer with trace sand (<5%). Total thickness of surface sediments at the unit is approximately 43.7 feet.

The basalt under LDU CPP-55, to a total depth of the borehole at approximately 123 feet, is a fresh, medium dark gray to dark gray, vesicular, aphanitic rock of medium strength. Scattered fractures and localized fracture zones were encountered. Interbeds, above 119 feet, consisted of unstratified, fine sand with little silt and clay. The interbed below 119 feet consisted of a stiff to hard, damp, non-stratified, clayey silt to silty clay. Stratigraphy below 123 feet is assumed to be similar to that described in Section 2.1 above.

3. HYDROGEOLOGICAL CHARACTERIZATION

The following information is provided as additional clarifying information to that presented in the September 1989 approved closure plan. This current information is more applicable to the ICPP area. The information supplied in the approved closure plan was based on regional hydrogeologic information.

3.1 Surface Water

The only surface water feature in the area of the ICPP is the dry channel of the Big Lost River. Water flow in the river is intermittent, with flows reaching to the ICPP area only during years of high spring run-off and snow melt from the surrounding mountains. The last time water reached the ICPP area was in 1987, when the river flowed for the entire year. Even during these wet years the river will normally only flow in the winter and spring months. The main channel of the Big Lost passes within approximately 20 feet of the northwest corner of the ICPP. The general slope of the surface for the ICPP is towards the river at approximately 0.07%.

3.2 Groundwater

All subsurface water at the ICPP, including the Snake River Plain Aquifer (SRPA), is under water table conditions. Due to the low permeability of the sedimentary interbeds various perched zones are formed as surface infiltration percolates down through the basalt. There are four perched zones of concern, with the zone at the 110 foot level designated, as per the RCRA definition, as the uppermost aquifer. It is agreed, however, that the deeper SRPA is the main aquifer of concern. These zones occur at:

- the sediment/basalt interface (approximately 40 - 50 feet below ground)
- the 110-foot interbed (a zone of thin basalt flows and sediment interbeds ranging from 90 to 120 feet below ground, and averaging approximately 50 - 60 feet thick)
- the 265-foot interbed (a low permeability cinder zone approximately 30 feet thick)
- the 365-foot interbed (another low permeability clay interbed approximately 20 feet thick)

These perched zones can be permanently formed under areas of constant infiltration (e.g., as beneath the percolation pond and sewage treatment trenches). However, the interbed permeability is such that, should the constant source be removed, these zones will dissipate in seven to eight months. Indications are that there is no hydraulic connection between these interbeds. The areal extent of these perched zones is under investigation.

4. WASTE TYPES KNOWN OR SUSPECTED

The waste type most likely to occur would be a mixture of paint diluted in paint thinner, which resulted from cleaning painting equipment (e.g., brushes and rollers). The quantity of wastes discarded at the unit is unknown, and the actual disposal locations could not be determined because the soil was not visibly stained by the solvents and there are no records of the incidents.

There are no records of the actual types or quantities of materials discarded at the unit. However, listed below are some of the more "typical" organics and heavy metals used in paints and paint thinners at the time of disposal (DeVoe Paints, 1990).

Solvents	Heavy Metals
Acetone	Cadmium
Benzene	Chromium
2-Butanone	Iron
Mineral spirits	Lead
Toluene	Mercury
Xylene	Nickel

The soil analyses conducted at the time of the incident (see Section 1.1) showed mercury contamination in the soil column to a depth of six inches, but these analyses can not be considered adequate for unit characterization because they were not conducted for organic solvents or heavy metals, other than mercury, and cadmium; also the analyses were not conducted before EPA approved methods were available. For these reasons, further characterization of the unit was deemed necessary to determine the nature and extent of contaminated soil.

5. PRE-CLOSURE SAMPLING AND ANALYTICAL RESULTS

As discussed in the approved closure plan, a two phased sampling plan was conducted for unit characterization. The first phase consisted of shallow soil sampling (6 feet) to determine if any hazardous constituents listed in Table 1 were present above the regulatory thresholds. Selected samples were analyzed for full 40 CFR 261 Appendix VIII and Target Compound List constituents (Appendix D.1). The second phase consisted of a deep borehole, to the upper confining layer, at 110 feet, to determine if any contamination had migrated to the perched groundwater below the unit.

Sampling and analysis activities were conducted by an independent sampling contractor (Golder Associates, Inc. of Redmond, WA), whose QA/QC program was reviewed and approved by WINCO QA auditors, prior to initiating work. The

Table 1.

Compound/Analyte	Compound/Analyte
Organics	Metals
Chloromethane	Arsenic
Bromomethane	Barium
Vinyl Chloride	Cadmium
Methylene Chloride	Chromium
Acetone	Iron
Carbon Disulfide	Lead
1,1-Dichloroethane	Mercury
1,1-Dichloroethene	Nickel
1,2-Dichloroethene (total)	Selenium
Chloroform	Silver
1,2-Dichloroethane	
2-Butanone	Radionuclides
1,1,1-Trichloroethane	
Carbon Tetrachloride	Americium 241
Vinyl Acetate	Plutonium 238
Bromodichloromethane	Neptunium
1,2-Dichloropropane	Antimony 125
cis-1,3-Dichloropropene	Cobalt 58
Trichloroethene	Cobalt 60
Dibromochloromethane	Cerium 144
1,1,2-Trichloroethane	Ruthenium 103
Benzene	Ruthenium 106
trans-1,3-Dichloropropene	Cesium 134
Bromoform	Cesium 137
4-Methyl-2-pentanone	Strontium 90
2-Hexanone	Uranium 234
Tetrachloroethane	Uranium 235
Toluene	Uranium 238
1,1,2,2-Tetrachloroethane	Iodine 129
Chlorobenzene	
Ethyl Benzene	
Styrene	
Xylenes (total)	

contractor was responsible for recovery, preservation, and storage of all samples until delivery to the laboratory for analysis. Drilling operations were conducted by the drilling subcontractor, Hawley Brothers Drilling of Blackfoot, ID.

Soil samples were analyzed by Pacific Northwest Environmental Laboratory, Inc. of Redmond, Washington, for the constituents shown in Table 1 (except for radionuclides). Fracture fillings from the deep borehole were analyzed by MetaTRACE, Inc. of St. Louis, Missouri for all Table 1 constituents including radionuclides. The 0 - 6 foot samples from borehole 6 were split and analyzed at Gulf Southern Environmental Laboratory, Inc. of New Orleans, Louisiana and by Southwest Laboratory of Oklahoma, Inc of Tulsa, Oklahoma, for dioxins and furans only. Radionuclides were analyzed for only after discovery of the contamination in the deep borehole.

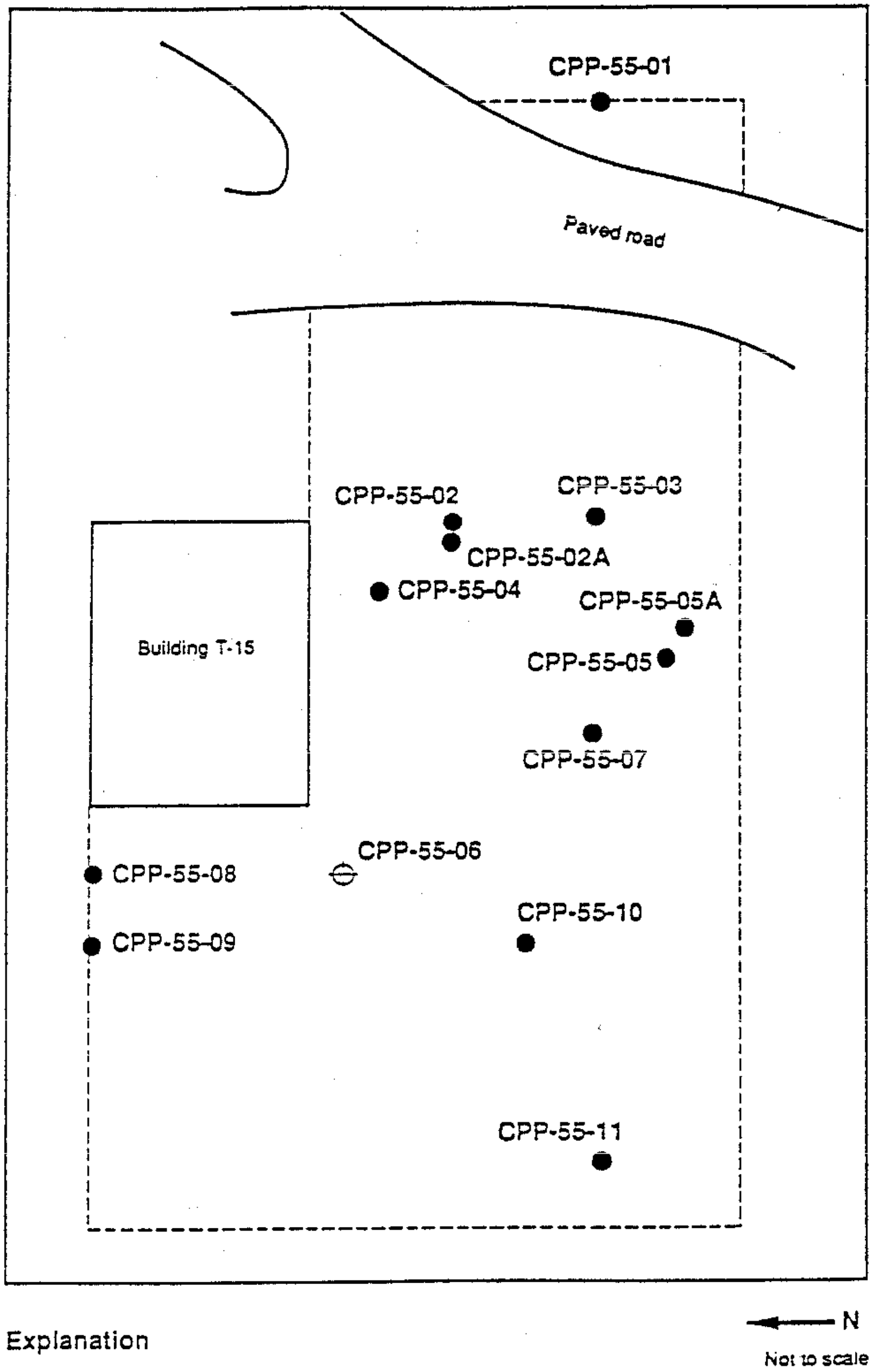
5.1 Unit Sampling

5.1.1 Sampling Locations

Eleven boring locations were randomly selected from the intersection points of a 10′ x 10′ grid (see Figure 4). Random sampling was deemed appropriate in that the discharges were small quantities over a potentially broad area. Ten borings were continuously cored to a depth of 6 feet and one boring was cored to a depth of approximately 103 feet. The 6 foot depth was chosen as a maximum depth in that the amounts discharged were small, and the possible contaminants potential for migration was negligible, since there is little hydraulic driving force.

5.1.2 Drilling

All shallow drilling was conducted between December 19, 1989 and January 5, 1990. The drilling operation for the deep borehole was conducted from February 6 to February 22, 1990. Borehole logs are presented in Appendix B.



Explanation

● Randomly selected shallow borehole locations located at the intersections of a 10' x 10' grid. Total depth = 6'

⊖ 110' borehole, location at 14'S, 32'W, from SE corner of Building T-15. Total depth = 122.9'.

FIGURE 4.
SAMPLING LOCATIONS AND BOREHOLE NUMBERS LAND DISPOSAL UNIT CPP-55

EG&G/ICPP/ID

OJECT NO. 893-1195.032 DWG. NO. 22097 DATE 7/5/90 DRAWN CB

All drilling was conducted using a Central Mining Equipment model 55 drill rig. Surface soils were drilled utilizing a 4" inside diameter (ID) hollow stem auger. An aluminum pan was placed around the augers to facilitate sample collection and prevent the spread of any contamination to the surrounding soil. Soil samples were collected using a 24 inch long x 4" outside diameter (OD) California split-spoon sampler driven ahead of the auger flight by a rig-mounted, cat-head operated 140 lb hammer. The number of hammer blows, for each six inches of sampler advancement, was recorded by the field geologist. Upon completion of sampling, each borehole was backfilled with clean native soil. As a precaution all waste drill cuttings were placed in 55 gallon DOT approved drums and shipped off site to a RCRA approved facility (USPCI of Murray, UT) for final disposal.

The deep borehole was drilled by first augering through the surface sediments with the 4" ID auger to the top of the basalt, approximately 44 feet. At that time, a temporary 6 inch casing was installed and coring continued into the bedrock using a CP series wireline coring devise. Coring continued until the total depth of approximately 123 feet was reached. All sediment and basalt samples were collected in clear lexan inner liners used in the sampling devices.

During routine health physics (HP) surveying of the drilling site and cores, unexpected radiologic contamination was detected in rock cores while drilling the deep borehole. The 5" borehole was not backfilled, but was instead converted to a 2" monitoring well following procedures as outlined in the RCRA Technical Enforcement Guidance document. Appendix B contains the boring log and well construction diagram for this unit. Further evaluation of this radiologic contamination is ongoing and will be addressed as a separate issue under the INEL Interagency Agreement.

5.1.3 Sampling Methods

As a result of frozen ground, only boring 55-01 was continuously cored utilizing a split-spoon sampler for the entire depth. All other borings sampled the 0 - 2 foot level by taking a grab sample of the material as it came off the auger flight into the aluminum pan. Below two feet all sediment samples were collected by driving the split-spoon sampler in 2 foot increments as outlined above. Adjacent to borehole CPP-55-05 a second borehole was used to collect the 0 - 2 foot sample, as a result of split-spoon refusal in the first borehole. Also, a second borehole labeled CPP-55-2A was needed after the split-spoon sampler encountered refusal at 2.7 feet in borehole CPP-55-02.

All samples were collected within a 24 inch clear lexan inner liner placed in the split-spoon. Once removed from the borehole, the sampler was placed on clean plastic sheeting and opened. The open ends of the lexan tube were scanned for beta-gamma radiation with all instrument readings recorded by the field geologist. The tube was then sealed and the soils logged. Once the sample was logged it was handed out of the exclusion zone set up around the drill rig for sample preparation. All soil sampling was conducted in accordance with the sampling contractors Technical Procedure TP1.2-5, "Drilling, Sampling, and Logging of Soils" (Golder 1990a). Furthermore, all samples were handled within the chain-of-custody procedures specified in TP-1.2-23 (Golder 1990a).

Sample preparation was conducted by the sampling subcontractor outside of the exclusion zone. In the sample prep area the lexan tube was opened and 2 to 4 inches of material from the top of the sample were removed and discarded. Samples collected for mineral spirits, semi-volatile, and volatile organic analyses were then immediately transferred into appropriate sample containers. Contact time with the lexan sampling liner was never more than 15 minutes, prior to sample removal. For this reason the possibility of cross contamination of organics is considered negligible. The remaining sample was homogenized, by mixing with a stainless steel rod in a stainless steel bowl, with a sub-sample being placed in an 8 ounce plastic sample container for inorganic analysis. Excess sample material was disposed of into WINCO managed waste containers. All sample containers were sealed with teflon lined lids and placed in a 4°C cooler for preservation prior to shipment to the appropriate laboratory. Grab samples from the 0′ - 2′ interval were placed directly into sample containers.

Deep borehole cores were collected in 5 foot lengths also within clear lexan liners. Upon removal from the borehole the lexan tube was sealed and logged in accordance to Technical Procedure TP-1.2-2, "Geotechnical Rock Core Logging" (Golder 1990a). These samples were handled under the same chain-of-custody procedure as the soil samples. Samples of fracture fillings were taken by uncapping the lexan tube, carefully extruding the core from the lexan tube, and scraping material into sample containers. The excess core was placed back in the lexan tube, sealed, and is archived at the ICPP.

5.2 Background Sampling

Ten background samples were collected in 1986 by the University of Utah Research Institute (UURI), Salt Lake City, UT., during two unit characterization studies (SWMU CPP-46 at the Chemical Storage and Zirconium Feed Storage Tank area and SWMU CPP-53 at the FPR Warehouse site). The background samples were collected from seven sample locations outside of the ICPP security fence (see Figure 5). Samples were collected at surface and at 6, 18, and 24 inches. All background samples were collected and analyzed using EPA methods. UURI's report stated that the soils taken from the background locations were geologically identical to the native soils in the sampling areas within the ICPP.

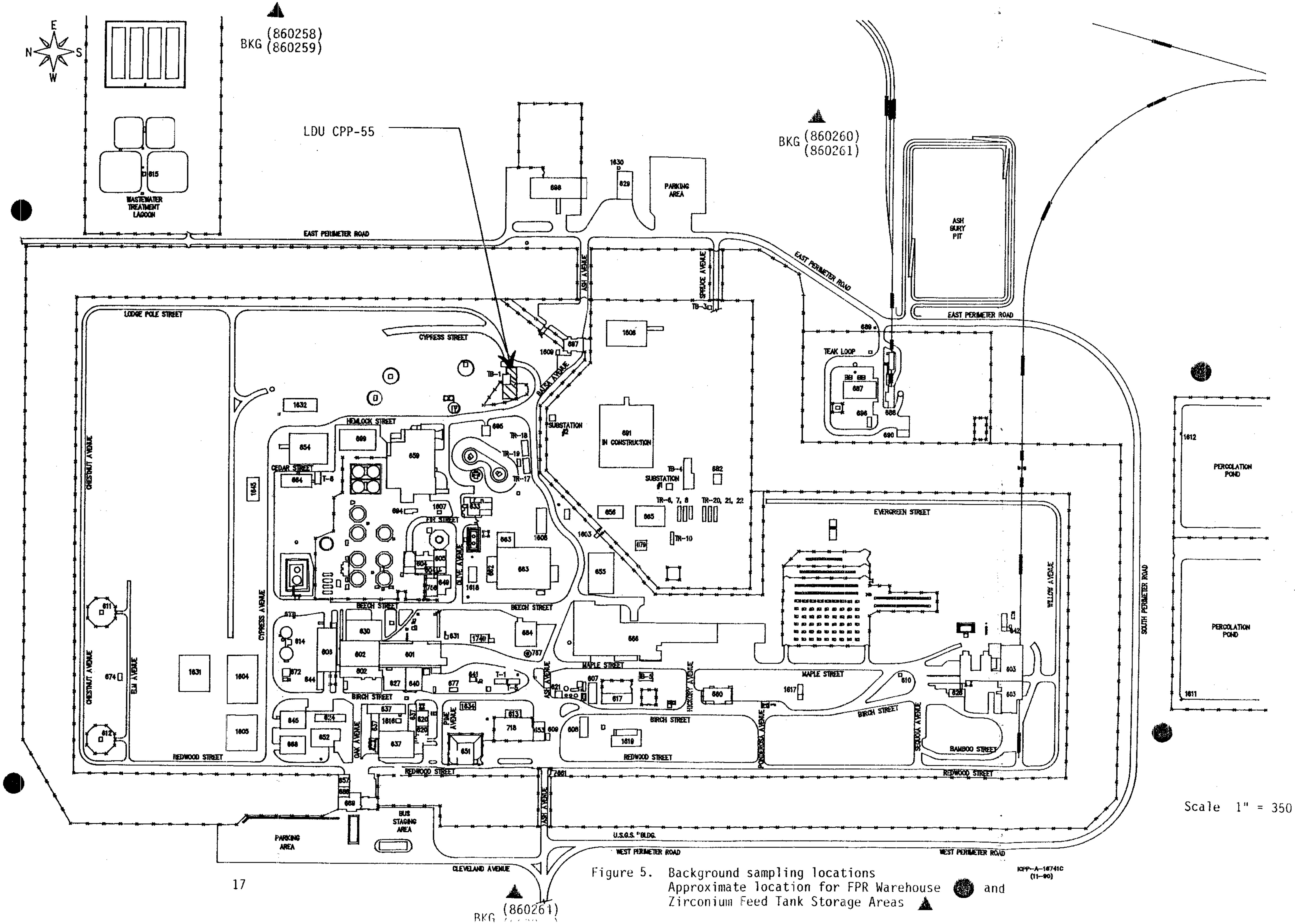


Figure 5. Background sampling locations
Approximate location for FPR Warehouse and
Zirconium Feed Tank Storage Areas

Samples and background samples collected for the FPR Warehouse Site (Bkg 1-4) were analyzed for the same hazardous constituents that were analyzed for during this unit characterization. Background samples collected for the Chemical Storage and Zirconium Feed Tank Storage Areas (258-265) were analyzed for pH, nitrates, aluminum, zirconium and heavy metals. The pertinent background sample results are shown in Table 2.

Since all background samples were collected adjacent to the ICPP and all sampling and analyses were conducted using EPA methods, the results will be used as a comparison with the shallow soil sample characterization data from this report. Section 5.7.2 discusses limitations on this data.

5.3 Quality Assurance Samples

Quality assurance samples submitted for LDU CPP-55 included eight trip blanks, three equipment blanks, three field blanks, four field duplicates, two decontamination rinseate, and one blind sample. Results of the quality assurance sample analyses are presented in Appendix C. Equipment blanks were prepared by collecting the final rinse water from the decontamination procedure described below. Field blanks were made utilizing the deionized water used for decontamination purposes. Field duplicates were made by splitting an original sample from a selected depth. The blind sample was prepared by spiking commercially available distilled water with an EPA quality control reference sample. Decontamination rinseate samples were collected from the decon trough prior to pumping into 55 gallon drums.

All quality assurance samples were analyzed using the same EPA approved methods as for soil samples and as outlined by the sampling subcontractors Quality Assurance Program Plan (Golder, 1990c). This QAPP was developed in accordance with NQA-1 and QAMS-005 guidance.

Table 2.

Background Concentrations of Metals in Soils Sampled from Outside the ICPP Facility and One-Sided Normal Tolerance Intervals[1]								
BACKGROUND SAMPLE	RESULTS IN PPM							
Sample	Arsenic	Barium	Cadmium	Chromium	Lead[2]	Mercury	Selenium	Silver
Bkg 1	5.6	200	<5	25	12	0.043	0.484	<2
Bkg 2	5.1	270	<5	32	16	0.019	0.405	<2
Bkg 3	6.5	270	<5	33	17	0.027	0.467	<2
Bkg 4	7	250	<5	34	12	0.028	0.341	<2
258	5.6	280	<5	28	<10	0.025	0.113	<2
259	7.6	380	<5	26	<10	0.057	0.252	<2
260	6.4	240	<5	28	<10	0.023	0.695	<2
261	6.2	220	<5	18	<10	0.03	0.236	<2
264	6	230	<5	28	<10	0.021	0.102	<2
265	7.6	210	<5	20	<10	0.046	0.227	<2
Maximium	7.6	380	<5	34	17	0.057	0.695	<2
Minimium	5.1	200	<5	18	<10	0.019	0.102	<2
Average	6.4	255	<5	27	9	0.032	0.332	<2
Std. Dev. (SD)	0.8	51	--	5	5	0.013	0.184	--
Background UTI[3]	8.7	403	--	42	24	0.070	0.868	--

1. All analyses are total constituent analyses, using EPA approved methods, and are reported on a weight per dry basis. Samples Bkg 1 - 4 were from the FPR Warehouse site (SWMU CPP-46); samples 258 - 265 were from the Zirconium Feed Storage Tank site (SWMU CPP-53).

2. Where lead values are listed below detection limit, a value of one-half the detection limit was used in the calculation of the average standard deviation and tolerance limit values.

3. The background one-sided upper tolerance interval (UTI) is x + K*SD, where the K value (tolerance factor) for sample size n = 10 is equal to 2.911 with a probability level y = 0.95 and coverage P = 0.95.

5.4 Radiation Survey

Radiation surveys were conducted by a WINCO Occupational Health Physicist (OHP) in accordance with WINCO Standard Operating Procedures (SOPs). A routine radiation survey of the drilling equipment was made prior to the rig entering or leaving the ICPP secured area. Radiation surveys were also conducted at the unit prior to commencing any sampling activities. All sediment samples were surveyed for direct radiation prior to removing samples from the unit. All instrument measurement results were logged in the Field Log Book by the field geologist.

Direct radiation was measured using Geiger-Mueller detection tubes, which were calibrated and used for the purpose of health protection and locating any radioactive "hot spots" within samples. The instruments were calibrated by the WINCO instrument laboratory prior to field use. Any field instrument used was operated by a trained radiation Operational Health Physicist (OHP) to ensure the safety of field and sampling personnel.

5.5 Sample Preservation Methods and Holding Times

Samples were not chemically preserved, however they were refrigerated at approximately 4°C. The samples were shipped in coolers and kept cooled until analysis. Any time sensitive soil sample analyses (e.g., those for volatile and extractable organics) were extracted within 7 to 14 days. All other analyses were conducted within the required 28 day limit.

5.6 Sample Packing and Shipping

The packing and shipping of soil samples containing hazardous substances is regulated by the Department of Transportation (DOT). All sample containers shipped were classified as environmental samples as required by the DOT. These were packed in a sealed shipping cooler surrounded by an inert packing material (vermiculite), a cooling agent ("blue ice"), a trip blank, and chain-of-custody documentation (Golder 1990a).

5.7 Data Validation, Evaluation, and Reporting

5.7.1 Data Validation

All analytical data was reviewed using EPA CLP equivalent methods, to ensure that the analytical laboratories met their requirements as outlined in the Technical Work Plan, (Golder, 1990a). In general, validation included a review of:

- sample receipt tracking documentation;
- instrument calibration documentation;
- quality control data;
- analytical results and/or data deliverables.

The specific requirements for the validation of data from unit LDU CPP-55 can be found in Volume II, Section 8 of the Technical Work Plan (Golder, 1990a).

MetaTRACE was employed for analysis of soil samples associated with fracture fillings at LDU CPP-55. The work performed by MetaTRACE included organic, inorganic, radionuclide and 40 CFR 261, Appendix VIII hazardous constituent analyses. This laboratory was already under contract with the sampling subcontractor, prior to being suspended from the EPA contract laboratory program (CLP) in March 1990. WINCO believes that the analytical work conducted by MetaTRACE is valid and defensible. Our reasons are as follows:

- MetaTRACE was assessed by the sampling subcontractor in compliance with ANSI/ASME NQA-1 QA program requirements through onsite evaluation prior to contract award.

- All of MetaTRACE's analytical results were subjected to rigorous independent validation in compliance with WINCO - approved validation protocols based on those used by the EPA in its CLP.

- The sampling subcontractor introduced blind performance audit samples into the samples delivered to MetaTRACE; all performance audit sample results were within the EPA-defined control limits.

- The sampling subcontractor conducted a laboratory surveillance at MetaTRACE on March 22, 1990, with WINCO QA, technical, and project management representatives observing. MetaTRACE was observed to have initiated corrective action measures related to the problems specified in the EPA directive.

The results of data validation indicate that all time sensitive soil sample analyses (i.e., those for volatile and extractable organics) were extracted within EPA specified holding time limits. All other analyses were conducted within the required 28 day limit. Holding times for organic analyses of soils have yet to be established, but the most recent proposed update to SW-846 recommends all soils, sediments, and sludges be analyzed within 14 days (EPA 1987).

Initial results of the analysis for mineral spirits reported levels above detection limits. However, upon undergoing validation procedures, were eliminated from consideration due to contamination found in all associated laboratory blanks. As part of the validation a review of the chromatograms for all mineral spirits revealed a substantial rise in the baseline. This was quantified by the laboratory as an indication of the presence of mineral spirits. Validation review determined the rise to be a false identification of an interferring contaminant, and thus eliminated all mineral spirits data from further consideration.

Organic compounds (toluene, 4-methyl 2-pentanone, and bis (2-ethylhexyl) phthalate) were detected and validated in some soil samples. These are all recognized as common laboratory contaminants and were found near or below the sample detection limits. Comparison of these compounds with results from the associated blanks and using the criteria and rationale as specified in Part XI of the EPA data validation guidelines (EPA 1988b) eliminated them from further consideration.

5.7.2 Data Evaluation

Background levels were determined from samples collected by the University of Utah Research Institute (UURI), Salt Lake City, Utah, during two studies conducted in 1986 and 1987. Ten background samples were collected outside the ICPP fence from the surface to a depth of 24 inches. A summary of this data is presented in Table 2. Also shown on this table is the one-sided upper tolerance interval (UTI) for the background data, assuming a normal distribution with 95% coverage of samples at a 95% confidence coefficient. A UTI is a concentration range, from background data, in which a large portion of the background observations should occur with a high probability. There are a number of caveats to the use of the UURI data for determining "action" levels to trigger cleanup activities. These limitations include:

- all UURI data is from the near surface (0" - 24") level and may not be representative of deeper soils;
- many areas of the ICPP have been graded or filled. Background samples collected by UURI represent native material and may not be representative of this fill material;
- certain constituents are elevated above natural background as a result of point and non-point sources as a result of site activities. It would be inappropriate to establish cleanup levels based on natural background if there is

widespread elevation of constituent concentrations not associated with releases from the LDU.

Organic constituents were evaluated to determine their presence above sample quantification limits. Inorganic results were evaluated to determine their presence above a listed background UTI (see Table 2).

If an inorganic analysis resulted in a concentration above the upper threshold interval (UTI), it was screened for EP-Toxicity leaching using an upper threshold limit (UTL). This UTL was used to determine if a sample approached a regulatory limit. Based on the required diluting of a sample, by a factor of 20, for conducting an EP-Toxicity leach test, the total constituent analyses threshold limits were established as the EP-regulatory threshold times 20. Therefore, if a sample exceeded its corresponding UTI, it was further screened to see if it exceeded its UTL. If the sample also exceeded its UTL, it was subjected to an EP-Toxicity leach test. More simply stated, if a constituent was detected above the background level (UTI) it was further evaluated to determine if it was above a derived regulatory threshold (UTL). If it was also above this threshold then a sample was subjected to an EP-Toxicity leach test. The EP-Toxicity results were then compared to the regulatory limit. Should the result be above the regulatory limit, then the material was considered a RCRA hazardous waste.

Analyses and screening showed that only five inorganics (arsenic, chromium, lead, mercury, and silver) and three organics (toluene, 4-methyl 2-pentanone, and bis (2-ethylhexyl) phthalate) were detected above their UTIs. Of these, only one mercury sample exceeded the UTL and was tested for EP-Toxicity. Analysis of the leachate from this test did not detect any mercury. The organics detected were all eliminated from further consideration during validation procedures (see Section 5.7.1).

5.7.3 Data Reporting

All data was reported to the sampling subcontractor in both their reduced and raw forms. Concentration values were presented with their appropriate units of measure and uncertainty values. Data, as presented to WINCO in the attached final report, was in its reduced form only. Therefore, the data as presented in this document, is given in its reduced form. Raw data information is available upon written request.

5.8 Sample Analysis

All soil samples were analyzed for the constituents shown in Table 1, except for radionuclides at Pacific Northwest Environmental Laboratory, Inc. of Redmond, Washington. Fracture fillings from the deep borehole were analyzed by MetaTRACE, Inc. of St. Louis, Missouri for all Table 1 constituents including radionuclides. The 0 - 6 foot samples from borehole 6 were split and analyzed at Gulf Southern Environmental Laboratory, Inc. of New Orleans, Louisiana and by Southwest Laboratory of Oklahoma, Inc. of Tulsa, Oklahoma, for dioxins and furans only. Radionuclides were not an original target analyte. They were added to the list and analysis only after discovery of the radiologic contamination in the deep borehole. Additional information associated with the sample collection and analysis can be found in the Technical Work Plan (Golder, 1990a).

5.8.1 Chemical/Radiological Sample Analysis

All samples were analyzed for hazardous constituents using EPA approved methods (SW-846). Analysis results were documented and validated using CLP equivalent methods following EPA data validation guidelines (EPA 1988a and 1988b).

Sample analyses were conducted on all soil samples from boreholes 1 through 5 and 7 through 11 for the constituents listed in

Table 1, except for the radionuclides. The soil samples from borehole 6 from the surface to 6 feet were analyzed for 40 CFR part 261 Appendix VIII parameters, Target Compounds List analytes not found under Appendix VIII, and radionuclides (see Appendix D). Samples from 6 feet to top of bedrock, were analyzed for Table 1 constituents with the exception of radionuclides and mineral spirits. Fracture fillings, from borehole CPP-55-06 were analyzed for all Table 1 parameters.

Of the inorganic constituents analyzed for only arsenic, chromium, lead, silver, and mercury exceeded their respective upper tolerance intervals (UTI) (see Section 5.7.2 for a description of the UTI). There is no apparent correlation between location of the elevated concentrations and depth of collection (see Table 3).

Arsenic and chromium exceeded their UTIs in only one sample each from two different boreholes, CPP-55-07 the 2′ - 4′ interval and CPP-55-11 the 4′ - 6′ interval, respectively. Lead exceeded the UTI in two samples, 0′ - 2′ and 2′ - 4′, from two different boreholes, CPP-55-05 and CPP-55-08, respectively. Silver exceeded the UTI in a number of samples, but never by more than 1 mg/kg. Furthermore, as a result of the statistical method utilized, the UTI for silver is artificially set at the detection limit. Thus, any silver detected would be above its UTI level. This was required in that all background UTIs for silver were below the current sample detection limit. To have used half the UTI in statistical methods would have yielded invalid results. The methodology incorporated was done in accordance with EPA approved methods. None of these metals approached their respective upper threshold limits (see Section 5.7.2 for discussion of upper threshold limit).

Mercury was the only inorganic constituent detected in more than two samples. It was detected from at least one depth in all but one borehole, CPP-55-01. The 0 - 2 foot sample generally contained the

Table 3.

Inorganic Sample Analysis Results
Land Disposal Unit CPP-55

Borehole	Depth	Arsenic mg/Kg	Barium mg/Kg	Cadmium mg/Kg	Chromium mg/Kg	Iron mg/Kg	Lead mg/Kg	Mercury mg/Kg	Nickel mg/Kg	Selenium mg/Kg	Silver mg/Kg
CPP55-01	0' - 2'	4.7	215.0	1.00 U	24.5	17,900	13.0	0.05 U	20.0	0.620 U	2.9
	2' - 4'	5.1	70.0	1.00 U	28.5	10,500	6.3	0.05 U	16.3	0.580 U	2.0 U
	4' - 6'	4.7	91.2	1.00 U	21.6	10,600	6.3	0.05 U	17.4	0.570 U	2.0 U
CPP55-02	0' - 2'	6.2	144.0	1.00 U	32.4	13,900	10.6	0.12	21.8	0.620 U	2.1 U
	2' - 4'	6.1	133.0	1.00 U	29.6	12,900	10.1	0.27	19.1	0.610 U	2.0 U
	4' - 6'	5.5	96.1	0.90 U	15.2	10,600	7.6	0.05 U	16.8	0.560 U	1.8 U
CPP55-03	0' - 2'	7.3	115.0	1.00 U	38.8	12,500	10.5	0.09 B	19.6	0.610 U	2.0 U
	2' - 4'	4.9	120.0	1.00 U	24.4	12,800	7.8	0.45	17.0	0.540 U	2.0 U
	4' - 6'	5.1	120.0	1.00 U	29.5	10,900	5.8	0.07 B	21.4	0.600 U	2.1 U
CPP55-04	0' - 2'	6.7	140.0	1.00 U	23.3	14,000	11.9	0.65	22.6	0.640 U	2.1 U
	2' - 4'	6.0	134.0	1.10 U	19.7	12,800	9.7	0.42	20.6	0.620 U	2.1 U
	4' - 6'	5.9	117.0	0.98 U	22.8	14,400	16.7	0.20	24.4	0.610 U	2.0 U
CPP55-05	0' - 2'	5.7	183.0	1.00 U	32.6	17,100	10.1	0.19	24.3	0.580 U	3.0
	2' - 4'	5.0	97.4	1.00 U	23.1	11,600	32.0	0.05 U	18.1	0.520 U	2.1
	4' - 6'	4.7	86.2	1.00 U	23.8	9,680	6.8	0.12	17.9	0.580 U	2.0
CPP55-06	0' - 2'	4.9	109.0	1.1	16.4	NA	8.9	0.11	20.4	0.410 U	0.5 U
	2' - 4'	5.0	88.9	0.99 U	13.3	NA	9.0	0.20	16.8	0.400 U	0.5 U
	4' - 6'	6.4	164.0	1.4	20.9	NA	8.6	0.22	27.6	0.400 U	0.7 U
CPP55-07	0' - 2'	5.6	134.0	1.00 U	21.8	13,000	8.4	0.58	18.6	0.610 U	2.1
	2' - 4'	13.4	106.0	1.00 U	21.1	11,500	9.6	0.05	17.5	0.530 U	2.0 U
	4' - 6'	8.0	82.0	1.00 U	15.8	8,660	14.5	0.05	16.0	0.500 U	2.0 U
CPP55-08	0' - 2'	6.5	138.0	0.98 U	25.4	15,100	28.7	0.08 B	65.0	0.630 U	2.0 U
	2' - 4'	6.1	134.0	0.90 U	25.3	15,100	7.9	0.05 U	22.2	0.590 U	1.9
	4' - 6'	6.1	95.3	0.87 U	21.2	13,100	6.9	0.05 U	18.7	0.600 U	1.7 U
CPP55-09	0' - 2'	8.0	163.0	0.99 U	40.5	18,100	11.0	0.13	26.5	0.590 U	2.0 U
	2' - 4'	7.1	134.0	0.94	20.9	14,300	10.7	0.05 U	18.8	0.630 U	1.9 U
	4' - 6'	6.2	108.0	1.00 U	17.9	12,100	7.2	0.05 U	18.1	0.570 U	2.0 U
CPP55-10	0' - 2'	4.7	181.0	1.00 U	29.9	17,200	9.0	0.49	24.1	0.560 U	2.3
	2' - 4'	6.2	160.0	1.00 U	29.5	16,300	10.4	0.11	23.9	0.560 U	2.5
	4' - 6'	6.0	88.2	1.00 U	18.3	11,300	6.3	0.05 U	16.0	0.560 U	2.0
CPP55-11	0' - 2'	5.2	148.0	1.00 U	25.1	14,500	9.7	5.20 *	21.5	0.530 U	2.4
	2' - 4'	3.8	133.0	1.00 U	26.4	16,100	6.9	0.05 U	25.4	0.600 U	2.4
	4' - 6'	4.4	105.0	1.00 U	64.7	11,500	6.1	0.05 U	20.2	0.570 U	2.1 U
Maximum value		13.4	215.0	1.40	64.7	18,100	32.0	5.20	65.0	0.640 U	3.0
Minimum value		3.8	70.0	0.87 U	13.3	9,680	5.8	0.05 U	16.0	0.400 U	0.5 U
Detection limit		3.0	10.0	1.00 U	10.0	50	3.0	0.05	20.0	0.500	2.0
Bkgrd UTI		8.7	403.0	5.00	42.0	—	21.0	0.07	—	0.870	2.0

U = compound was analyzed for but not detected, the reported value is the sample detection limit.

* = result is the average of three analyses, 7.1, 5.7 and 2.8 mg/Kg.

highest concentrations at most sampling sites. Only one sample, 0′ - 2′, from CPP-55-11 contained concentrations above both the UTI and the test no mercury was detected (see Table 4). This single sample is from one of the locations farthest from the potential discharge sourceupper threshold limit. When subjected to the required EP-Toxicity leach (building T-15). Since the reported value is the average of three widely varied analytical results, the concentration vs distance is probably related more to some heterogeneity in the soil than to a discrete disposal event. This is further supported by the fact that only this sample at this location was above detection limits.

Three organic constituents, toluene, 4-methyl 2-pentanone, and bis (2-ethylhexyl) phthalate were detected from the volatile organic analyses (see Table 5). During validation procedures all were eliminated from further consideration as they are all recognized laboratory contaminants as illustrated in Section 5.7.1 of this report and Section 3.3 of (Golder, 1990c). Furthermore, concentrations of toluene and 4-methyl 2-pentanone were detected near or below detection limits (5 and 10 ug/kg respectively). Bis (2-ethylhexyl) phthalate, though above detection limits, was also found in associated laboratory blanks.

Deep soil samples (below 6 feet) were not evaluated against UTIs because of the shallow depth of the background samples. They were, however, screened against their derived upper threshold limit (UTL). In general, the concentrations were higher the deeper the sample collection depth. Table 6 lists the concentrations found in the deeper soils. It should be noted that no metals exceeded their respective UTLs.

Radioactive contamination, mainly strontium-90, was detected at significant levels in the deeper fracture fillings within the basalt, and in lower concentrations in the perched water. For this reason the borehole CPP-55-06 was converted to a 2" RCRA monitor well. Since there is no potential source and no evidence of strontium release at the surface, this contamination is thought to have migrated laterally from a

Table 4.

Borehole: CPP-55-11 Depth: 0' to 2'				
Analytical Parameter	Total Results (mg/Kg)	Threshold Limit (UTL) (mg/Kg)	EP-Toxicity Results (mg/Kg)	Regulatory Limit (mg/L)
Arsenic	5.2	100	0.003 u	5.0
Barium	148	2000	1.194	100.0
Cadmium	1.0 u	20	0.005 u	1.0
Chromium	25.1	100	0.01 u	5.0
Lead	9.7	100	0.003 u	5.0
Mercury	5.2*	4	0.0001 u	0.2
Selenium	0.53 u	20	0.003 u	1.0
Silver	2.4	100	0.01 u	5.0

u = signifies the compound was analyzed for but not detected. The listed value is the sample detection limit.

* = signifies the result is an average of three consecutive measurements of 7.1, 5.7, and 2.8 mg/Kg.

UTL is described in text section 5.7.2.

Regulatory Limit refers to EP-Toxicity characteristic limit as specified in 40 CFR Part 261.24, Table I.

Table 5.

Organic Sample Analysis Results					
Borehole	Depth (ft)	4-Methyl-2-Pentanone ug/Kg	Toluene ug/Kg	Bis(2-ethylhexyl)-phthalate ug/Kg	High Boiling Point Hydrocarbons mg/Kg
CPP55-01	0 - 2 2 - 4 4 - 6	10u 10u 10u	1j 5u 5u	330u 330u 330u	NA NA NA
CPP55-02	0 - 2 2 - 4 4 - 6	10u 10u 10u	3j 5u 5u	330u 330u 330u	NA NA NA
CPP55-03	0 - 2 2 - 4 4 - 6	10u 10u 10u	5u 5u 5u	330u 330u 330u	NA NA NA
CPP55-04	0 - 2 2 - 4 4 - 6	10u 10u 10u	5u 5u 5u	330u 330u 330u	NA NA NA
CPP55-05	0 - 2 2 - 4 4 - 6	10u 10u 10u	5u 5u 5u	330u 330u 330u	440 NA NA
CPPP55-06	0 - 2 2 - 4 4 - 6	15 10u 10u	5u 5u 5u	1800 4000 330u	NA NA NA
CPP55-07	0 - 2 2 - 4 4 - 6	10u 10u 10u	5u 5u 5u	330u 330u 330u	NA NA NA
CPP55-08	0 - 2 2 - 4 4 - 6	10u 10u 10u	5u 5u 5u	330u 330u 330u	NA NA NA
CPP55-09	0 - 2 2 - 4 4 - 6	10u 10u 10u	5u 5u 5u	330u 330u 330u	NA NA NA
CPP55-10	0 - 2 2 - 4 4 - 6	10u 10u 10u	5u 5u 5u	330u 330u 330u	NA NA NA
CPP55-11	0 - 2 2 - 4 4 - 6	10u 10u 10u	5u 5u 5u	330u 330u 330u	NA NA NA
Maximum value		15	5u	4000	440
Minimum value		10u	3j	330u	NA
Detection limit		10	5	330	NA

u = compound analyzed for but not detected, the reported value is the sample detection limit.

j = indicates an estimated value. Used when estimating a concentration for tentatively identified compounds where a 1:1 responce is assumed, or when the mass spectral data indicate the presence of a compound that meets the identification criteria but the result is less than the sample detection limit but greater than zero.

High boiling point hydrocarbons were determined by GC/FID (Modified EPA Method 8015/CDOHS method).

Table 6

Inorganic and Radiochemical Analysis Results (mg/Kg or pCi/g)
Borehole 6, Land Disposal Unit CPP-55

Borehole	Depth	Arsenic	Barium	Cadmium	Chromium	Iron	Lead	Mercury	Nickel	Selenium	Silver	Strontium 90		Potassium 40	
CPP55-06	0′ - 2′	4.9	109.0	1.10	16.4	NA	8.9	0.11	20.4	0.410 U	0.5 U	NA		NA	
	2′ - 4′	5.0	88.9	0.99 U	13.3	NA	9.0	0.20	16.8	0.400 U	0.5 U	NA		NA	
	4′ - 6′	6.4	164.0	1.40	20.9	NA	8.6	0.22	27.6	0.400 U	0.7 U	NA		NA	
A	6′ - 8′	5.9	141.7	1.01 U	21.4	11,200	6.6	0.14	22.7	0.550 U	2.0 U	NA		NA	
L	8′ - 10′	12.1	115.1	1.06 U	20.1	11,820	6.9	0.30	24.6	0.610 U	2.1 U	NA		NA	
L	10′- 12′	5.9	98.5	1.02 U	16.0	7,674	7.5	0.05 U	14.6	0.550 U	2.0 U	NA		NA	
U	16′- 18′	5.4	122.9	1.03 U	15.1	9,473	9.0	0.05 U	13.8	0.550 U	2.1 U	NA		NA	
V	20′- 22′	6.6	136.9	0.88 U	23.9	11,400	7.2	0.05 U	19.8	0.620 U	1.8 U	NA		NA	
I	24′- 26′	5.6	125.7	0.98 U	21.8	11,970	6.0	0.05 U	21.6	0.580 U	2.0 U	NA		NA	
U	28′- 30′	6.5	133.7	0.88 U	17.6	10,790	6.8	0.05 U	17.5	0.530 U	1.8 U	NA		NA	
M	32′- 34′	6.0	114.8	1.00 U	17.7 U	10,690	6.8	0.04 U	16.8	0.620 U	2.0 U	NA		NA	
	36′- 38′	6.5	117.2	0.98 U	18.7	10,220	6.7	0.05 U	15.5	0.570 U	2.0 U	NA		NA	
BASAL	40′- 42′	8.4	223.1	1.10 U	35.5	22,190	14.7	0.05 U	32.2	0.640 U	2.2 U	NA		NA	
CLAY	42′- 44′	10.0	238.6	1.10 U	41.5	22,330	15.8	0.06 U	35.4	0.590 U	2.2 U	NA		NA	
FRAC. FILL	111′	7.6	426.0	0.70 U	13.8	46,365	8.1	0.10 U	100.0	0.700 U	6.0	4800	500	14	2
FRAC. FILL	115′	5.2	398.0	0.70 U	27.6	49,174	8.0	0.10 U	121.0	0.700 U	6.1	4300	500	16	2
INTERBED	117′	7.9	609.0	0.80 U	36.0	21,953	4.1	0.10 U	52.6	0.800 U	2.9	1	U	28	3
INTERBED	119′	7.4	295.0	1.20	31.1	25,226	5.0	0.10 U	48.6	0.600 U	3.8	1	U	29	3
INTERBED	121′	6.6	359.0	0.80 U	33.0	27,098	5.9	0.10	51.0	0.800 U	3.6	1	U	28	3
Maximum value		12.1	609.0	1.40	41.5	49,174	15.8	0.30	121.0	0.800 U	6.1	4800		29	
Minimum value		4.9	88.9	0.70 U	13.3	7,674	4.1	0.04 U	13.8	0.400 U	0.5 U	4300		14	U
Detection Limit		3.0	10.0	1.00	10.0	50	3.0	0.05	20.0	0.500	2.0	1 U		1	

U = Compound was analyzed for but not detected the associated value is the sample quantitation limit.

separate source, and, as such, will be treated separately from the issue of CPP-55.

5.8.2 Quality Assurance Sample Analysis

The quality of sample data is of utmost importance. Quality assurance/quality control (QA/QC) procedures were implemented throughout the collection and analysis of samples. QA/QC procedures utilized during the chemical analysis portion of this program consisted of the following:

- analysis of trip, equipment, and field blank samples for monitoring of potential contamination introduced from the sampling containers, decontamination process, or the shipping containers;
- analysis of field duplicate samples for the measurement of overall field and laboratory precision;
- analysis of blind reference samples for volatile organics and selected trace metals;
- analysis of decontamination rinseate for characterization and determination of disposal requirements;
- a procedure audit was conducted at the sampling site during routine sample collection and
- an analysis audit was preformed at one of the contract laboratory facilities to track handling and analysis of samples.

All QA samples were analyzed by the same methods used for the soil samples. Results of the QA sample analyses are listed in Appendix C.

6. CLOSURE PROCEDURES

Section 5 of the approved closure plan stated that "If the unit is contaminated above RCRA regulatory thresholds, the unit will be clean-closed". Since none of the detected constituents were above RCRA regulatory thresholds for EP-Toxicity and no listed waste were detected, this unit will not require removal action to obtain clean closure and can be safely eliminated as a hazardous site.

The concentrations of the constituents were also below the risk based action levels listed in the proposed RCRA corrective action guidelines (Federal Register Vol. 55, No. 145, pp 39798-30884). Furthermore, a Health and Environmental Assessment of the unit (see Appendix A) showed that the highest risk factor to be from ingestion of chromium contaminated soil (at 1.3×10^{-5} for a residential adult scenario). Risk associated with the most wide spread contaminant found, mercury, is at the 1.0×10^{-6} level for the same scenario. Since the site is located within a fenced security area that is anticipated to continue operations well into the next century, the use of the residential scenario is very conservative.

7. DECONTAMINATION PROCEDURES

Prior to use, all split-spoon samplers, lexan liners, and associated sampling equipment were decontaminated by the sampling subcontractor. Decontamination is specified in Section 5 of the attached Technical Work Plan and consisted of:

- steam cleaning equipment with deionized water;
- drying, then wiping with a methanol dampened rag;
- air drying and a final rinse with deionized water;
- wiping dry and wrapping in clean, fresh plastic until needed.

The drill rig was decontaminated by the drilling subcontractor, under direction of the sampling subcontractor, before moving on site. Decontamination consisted of high pressure steam cleaning at a site designated by WINCO personnel. After steam cleaning sampling personnel visually inspected the rig for signs of grease, hydraulic fluid, or other potentially contaminating materials. A routine radiation survey was also conducted prior to the rig entering and leaving the ICPP secured area.

Decontamination rinseate from the washing of the sampling equipment was collected in a decon trough. Samples of this rinseate were collected prior to pumping out the trough and analyzed for proper disposal. Rinseate was pumped from the trough into 55 gallon DOT approved drums, for storage and disposal, after sampling.

8. POST-REMOVAL SAMPLING AND ANALYTICAL PROCEDURES

Since LDU CPP-55 is being presented for clean closure without removal, post-removal sampling and verification will not be required. If, under the upcoming INEL Interagency Agreement, further action is deemed necessary, it will be addressed at that time.

9. CLOSURE QUALITY ASSURANCE/ QUALITY CONTROL PROCEDURES

All administrative, sampling, and analysis activities were performed in accordance with sound QA/QC procedures. These procedures are outlined in the Quality Assurance Program Plan: INEL/ICPP Land Disposal Unit Characterization Support (Golder Assoc., 1990c) and the Quality Assurance Project Plan for Drilling and Sampling at Land Disposal Units CPP-34 and CPP-55 (Golder Assoc., 1990a). These plans meet the requirements for proper QA program controls by incorporating all applicable sections of ANSI/ASME NQA-1, Quality Assurance Program Requirements for Nuclear Facilities, and EPA's Interim Guidelines for Preparation of Quality Assurance Project Plan, QAMS/005.

10. CLOSURE CERTIFICATION

Since LDU CPP-55 is to be clean closed without removal, closure certification may not be required. If deemed necessary this certification will be provided to verify that sampling was done in accordance with the procedures outlined in the approved closure plan.

11. AREA RESTORATION

Since no remedial actions are anticipated for this site, area restoration will not be required. If future activities are preformed at this site, restoration concerns will be addressed at that time. All drilling spoils were containerized and disposed of under ICPP waste management procedures.

12. OTHER TOPICS OF CONCERN

At this time, based on regulatory limits and health and environmental assessments there are no other concerns dealing with this unit. The radioactive contamination found from 69 feet to 119 feet in the deep borehole is to be investigated further as characterization of the 110 foot interbed is carried out.

13. SCHEDULE OF ACTIVITIES

This document is being submitted to EPA Region X and the State of Idaho for final approval of the closure plan submitted in January 1989 and approved in September of 1989.

14. POST CLOSURE

Since the hazardous constituents detected were all below regulatory concerns and do not pose any unacceptable risk to human health or the environment, post closure requirements under RCRA (40 CFR 265.117 - 120) and the Consent Order and Compliance Agreement will not be required for this unit.

Future activities deemed necessary under the upcoming INEL Interagency Agreement may require post closure monitoring. The ICPP is currently developing a detailed facility wide Groundwater Monitoring Plan as required under 40 CFR 265.90 to address all units.

15. REFERENCES

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APPENDIX A

HEALTH AND ENVIRONMENTAL ASSESSMENT

HEALTH AND ENVIRONMENTAL ASSESSMENT

A Health and Environmental Assessment (HEA) is conducted to evaluate the potential harmful impacts of hazardous constituents present at a site. The HEA involves identifying the contaminants of concern, the concentrations of those contaminants in the affected environmental media, and the exposed, or potentially exposed, human and environmental receptors. The essential element of any HEA is the development of appropriate health and environmental criteria, to which the measured toxin concentrations can be compared. These criteria are based primarily on EPA-established chronic exposure limits. When one or more of these criteria are exceeded, there is the likelihood for adverse health or environmental effects.

The following HEA evaluates the potential impacts associated with the contaminants detected in the sampling program for LDU CPP-55.

A.1 IDENTIFICATION OF TOXIC CONTAMINANTS

Analyses for the presence and concentration of ten metals were conducted on the shallow soil samples from LDU CPP-55. Of the ten metals analyzed, five were either not detected or are essential elements for human health at the concentrations of concern. Silver was not evaluated because of its low, uniform distribution. The remaining four metals, arsenic, chromium, lead, and mercury, were assessed for health and environmental impacts.

Arsenic is a suspected human carcinogen by inhalation and is a confirmed skin carcinogen via ingestion. Arsenic may occur in either of two valence states, the trivalent (+3) and the pentavalent (+5). The trivalent form is more toxic than the pentavalent form; and the inorganic form is more toxic than the organic form.

Chromium exists in one of three valence states (+2, +3, +6). Adverse health affects are associated with the hexavalent form. This form is associated with lung and respiratory tract cancer resultant from inhalation. There is no evidence of carcinogenicity from ingestion of hexavalent chromium.

Lead is a well documented cumulative toxin, associated within laboratory animals. Because of the extremely low blood lead levels at which adverse effects can occur, the EPA has recommended that neither a chronic reference dose nor a numerical cancer risk estimate be used.

Mercury toxicity is highly dependent on the form, organic or inorganic, and the route of exposure, inhalation or ingestion. Target organs for toxic effects are the central nervous system and kidneys. Mercury has not been classified as a human carcinogen.

Of the three organic compounds detected, toluene, bis (2-ethylhexyl) phthalate (BEHP), and 4-methyl 2-pentanone, none were found at levels that would pose a health or environmental hazard. Conservative screening calculations of BEHP, a possible human carcinogen, is 1E-08. Thus no organic compounds were evaluated in this HEA.

A.2 IDENTIFICATION OF EXPOSURE PATHWAYS

The contamination detected at CPP-55 has been localized in the soil. Migration and transportation of these metals to other media could influence potential exposure pathways. However, due to the extreme depth to groundwater, the lack of any nearby surface water bodies, and the extremely low vapor pressures of these compounds, the main routes for exposure are through ingestion and dermal contact with contaminated soil. Because of the chemical forms of these metals in soils, the primary concern is through ingestion.

A.3 IDENTIFICATION OF RECEPTOR POPULATIONS

The identification of a receptor population for exposure at LDU CPP-55 is very straightforward. This unit is located inside of a secured area with limited access. Therefore, a reasonable assumption is that an adult worker represents the typical receptor (industrial scenario). For comparison purposes, and to evaluate the carcinogenic risk for arsenic, an adult residential scenario was also calculated.

A.4 HUMAN HEALTH ASSESSMENT

Screening criteria and calculated intakes for the identified metals, using soil ingestion as the exposure route and an adult worker as the receptor, were used to assess the human health effects at LDU CPP-55. Table A.1 summarizes the results of this assessment.

General assumptions used in this calculation include:

- Maximum concentrations of detected metals were used;
- toxicity is limited to chronic toxicity or carcinogenicity;
- chemical intakes were calculated using the EPA standard intake equation (EPA 1989c);
- upper bound exposure parameters, as recommended by USEPA Region X, were used in all intake calculations (EPA, 1990b).

Several criteria were used to evaluate the potential health effects of the metals detected at LDU CPP-55. First was the calculation of a maximum allowable soil concentration based on system toxicity and using a sensitive population (16kg child, ingesting 200 mg of soil per day over a 5 year period). This screening criteria was conducted as recommended in the RCRA Facility Investigation Guidance (EPA, 1989c). Soil concentrations for arsenic, chromium, and mercury did not exceed the calculated maximum. The calculation for lead was not conducted because its concentration (32 mg/kg) was below that necessary to produce an increase in blood lead levels in children (>500 mg/kg).

Secondly, when chronic intakes from exposure for both scenarios were compared to background levels only chromium and mercury exceeded the chronic intake health risk that might occur with exposure to background levels of these metals.

Constituent	Background Soil Concentration (mg/kg)	Maximum Detected Soil Concentration 0 - 2' (mg/kg)	Maximum Detected Soil Concentration 0 - 6' (mg/kg)	Screening Criteria: Chronic Oral/RfD (mg/kg/day)	Screening Criteria: Chronic Intake from Background (mg/kg/day)	Screening Criteria: Maximum Soil Concentration for Sensitive Population (mg/kg)	Chemical Intake and Hazard Quotients: Industrial Scenario Chemical Intake (mg/kg/day)	Industrial Scenario Hazard Quotient	Residential Adult Scenario Chemical Intake (mg/kg/day)	Residential Adult Scenario Hazard Quotient	Other Information
Arsenic	8.7	8.0	13.4	1E-3 [a]	1.7E-6	80 [d]	3.6E-6	0.0036	2.7E-6	0.0027	Cancer Risk Associated with Oral Arsenic Intakes: Background : 2.9E-6 Industrial : 6.1E-6 Residential : 4.6E-6
Chromium	42	40.5	64.7	5E-3 [b]	8.4E-6	400 [d]	1.8E-5	0.0036	1.3E-5	0.0026	There is no evidence that chromium (VI) is carcinogenic by the oral route
Lead	21	28.7	32	ND [a]	4.2E-6	500 [e]	8.6E-6	—	6.4E-6	—	Quantitative evaluation not recommended because toxic effects may be without a threshold
Mercury (Inorganic)	0.07	5.2	5.2	3E-4 [a]	1.4E-8	24 [d]	1.4E-6	0.0047	1.0E-6	0.0033	RfD based on adverse central nervous system effects

a Source: Health Assessment Summary Tables, Fourth Quarter, 1989.
b Source: Integrated Risk Information System (IRIS) Access Date 4/4/90.
c Not Determined.
d Calculated Soil Concentrations.
e Soil Lead Concentrations > 500mg/kg May Produce Increase Blood Lead Levels in Children

Table A.1
SUMMARY OF HEA FOR LDU CPP-55
EG&G/ICPP/ID

PROJECT NO. 893-1195.032 DWG NO. 22164 DATE 5/9/90 DRAWN DC

Golder Associates

The final criteria compared the calculated chemical intake with the chronic oral reference dose published in either the Integrated Risk Information Service or the Health Assessment Effects Summary Tables. The chronic oral reference dose (RfD) is defined as the dose to which an individual might be exposed on a daily basis for a lifetime without developing documented critical toxic effects. None of the chronic chemical intakes for any of the constituents found at LDU CPP-55, for either residential or industrial scenarios, were above their respective RfDs.

To further characterize the potential non-cancer health effects from exposure the hazard quotient (ratio of chemical intake to RfD) was calculated. The non-cancer hazard quotient assumes that there is a level of exposure below which even very sensitive populations may experience no adverse health effects. If this ratio exceeds 1.0, then there may be concern for potential non-carcinogenic health effects. All hazard quotients, for the three metals evaluated (lead does not have an RfD), were significantly below 1.0 (see Table A.1). The combined hazard quotient for the effects of all three metals was also significantly below 1.0 (0.0119 for the industrial scenario and 0.0086 for the residential scenario).

Because of the documented carcinogenicity associated with the oral exposure route to arsenic a cancer risk for this unit was calculated. The risk for all exposure scenarios was found to be at the 1×10^{-6} level (see Table A.1).

A.5 ENVIRONMENTAL ASSESSMENT

Arsenic, chromium, and lead exhibit low potential toxicity for plants and somewhat higher toxicity for animals. Mercury will readily translocate in plants and may undergo biomagnification in the food chain, and is particularly toxic to aquatic animals. However, the potential for environmental effects from the contamination at the site is minimal. LDU CPP-55 is located within a fenced industrial area. Vegetation within the ICPP is controlled with herbicides, while large animals are restricted from the area by animal control fences.

APPENDIX B

BOREHOLE LOGS

PROJECT: WINCO/ICPP/ID

PROJECT LOCATION: INEL

PROJECT NUMBER: 893-1195.020

RECORD OF BOREHOLE CPP-55-2

BORING DATE: 4 JANUARY 1990

BORING LOCATION: ICPP-55

SHEET: 1 OF 1

DATUM: MSL

DEPTH SCALE FEET	BORING METHOD	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV / DEPTH	SAMPLES: NUMBER	TYPE	BLOWS / 6 in	N	REC/ATT	PENETRATION RESISTANCE BLOWS/FT (20 40 60 80); WATER CONTENT, PERCENT (Wp W Wl)	PIEZOMETER OR STANDPIPE INSTALLATION
0	4-INCH HOLLOW STEM AUGER (HSA)	Dense (frozen), dark yellowish brown (10YR4/2), unstratified, damp, GRAVEL and SAND, trace silt, (GW-SW) (FILL)			0.00							
1			GW-SW			1	G	N/A		2.0/2.0		
2		Dense (frozen), dark yellowish brown (10YR4/2), unstratified, damp, SAND and GRAVEL, trace silt, (GW-SW) (FILL or ALLUVIUM)			2.00							
3			GW-SW			2	G	N/A		2.0/2.0		
4		Very dense, dark yellowish brown (10YR4/2), unstratified, damp, SAND and GRAVEL, little silt, (SW-GW) (FILL or ALLUVIUM)			4.00							
5			SW-GW			3	HD	23,92,90	182	1.5/2.0		
6		6.0 FT TOTAL DEPTH OF BOREHOLE Note: HD refers to a 4.0 inch OD split spoon advanced with a 140 lb. hammer with a 30 inch drop.			6.00							
7												
8												

DRILL RIG: CME-55

DRILLING CONTRACTOR: Hawley Brothers

DRILLER: Dan Hawley

Golder Associates

LOGGED: S Brandenberger

CHECKED: R. Burk

DATE: 19 JANUARY 1990

PROJECT: WINCO/ICPP/ID
PROJECT LOCATION: INEL
PROJECT NUMBER: 893-1195.020

RECORD OF BOREHOLE CPP-55-1

BORING DATE: 19 DECEMBER 90
BORING LOCATION: ICPP-55

SHEET: 1 OF 1
DATUM: MSL

DEPTH SCALE FEET	BORING METHOD	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV / DEPTH	SAMPLES NUMBER	TYPE	BLOWS / 6 in	N	REC/ATT	PENETRATION RESISTANCE BLOWS/FT ■ (20 40 60 80) / WATER CONTENT, PERCENT Wp W Wl	PIEZOMETER OR STANDPIPE INSTALLATION
0	4 INCH HOLLOW STEM AUGER (HSA)	Very dense (frozen), dark yellowish brown (10YR4/2), unstratified, damp, SAND and fine GRAVEL, some Silt, (SM-GM) (FILL) 0.0-0.5 ft: clay layer 1.0-1.1 ft: clay layer	SM-GM		0.00	1	HD	242,427,341,271	612	2.0/2.0		
2		Very dense, dark yellowish brown (10YR4/2), unstratified, damp, SAND and fine GRAVEL, little silt, (SW-GP) (FILL or ALLUVIUM)	SW-GP		2.00	2	HD	26,30,29,33	62	1.6/2.0		
4		Very dense, dark yellowish brown (10YR4/2), unstratified, damp, SAND and GRAVEL, trace silt, (SW-GW) (FILL or ALLUVIUM)	SW-GW		4.00	3	HD	21,26,27,30	57	1.6/2.0		
6		6.0 FT TOTAL DEPTH OF BOREHOLE Note: HD refers to a 4.0 inch OD split spoon advanced with a 140 lb. hammer with a 30 inch drop.			6.00							

DRILL RIG CME-55
DRILLING CONTRACTOR Hawley Brothers
DRILLER Dan Hawley

Golder Associates

LOGGED T Griffin
CHECKED R. Burk
DATE 19 DECEMBER 90

PROJECT: WINCO/ICPP/ID

PROJECT LOCATION: INEL

PROJECT NUMBER: 893-1195

RECORD OF BOREHOLE CPP-55-2A

BORING DATE: 4 January 90

BORING LOCATION: ICPP-55

SHEET: 1 OF 1

DATUM: MSL

DEPTH SCALE FEET	BORING METHOD	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV / DEPTH	SAMPLES: NUMBER	TYPE	BLOWS / 6 in	N	REC/ATT	PENETRATION RESISTANCE BLOWS/FT / WATER CONTENT, PERCENT Wp W Wl	PIEZOMETER OR STANDPIPE INSTALLATION
0	4 INCH HOLLOW STEM AUGER (HSA)				0.00							
		Dense (frozen), dark yellowish brown (10YR4/2), unstratified, damp, GRAVEL and SAND, trace Silt, (SW-GW) (FILL)										
1			SW-GW			1	G	N/A		2.0/2.0		
2					2.00							
		Dense, Dark yellowish brown (10YR4/2), unstratified, damp, GRAVEL and SAND, trace Silt, (SW-GW) (FILL)	SW-GW			2	HD	50+		0.0/0.7		
					2.70							
3		2.7 FT TOTAL DEPTH OF BOREHOLE										
		Note: HD refers to a 4.0 inch OD split spoon advanced with a 140 lb. hammer with a 30 inch drop.										
4												
		Refer to Record of Borehole CPP-55-2										
5												
6												
7												
8												

DRILL RIG: CME-55

DRILLING CONTRACTOR: Hawley Brothers

DRILLER: Dan Hawley

Golder Associates

LOGGED: S Brandenberger

CHECKED: R Burk

DATE: 4 January 90

PROJECT: WINCO/ICPP/ID

PROJECT LOCATION: INEL

PROJECT NUMBER: 893-1195.020

RECORD OF BOREHOLE CPP-55-3

BORING DATE: 19 JANUARY 1990

BORING LOCATION: ICPP-55

SHEET: 1 OF 1

DATUM: MSL

DEPTH SCALE FEET	BORING METHOD	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV / DEPTH	SAMPLES NUMBER	TYPE	BLOWS / 6 in	N	REC/ATT	PENETRATION RESISTANCE BLOWS/FT ■ (20, 40, 60, 80) / WATER CONTENT, PERCENT Wp —○W— Wl	PIEZOMETER OR STANDPIPE INSTALLATION
0	4 INCH HOLLOW STEM AUGER (HSA)	Very dense (frozen), dark yellowish brown (10YR4/2), unstratified, dry, SAND and fine GRAVEL, little silt and clay, (SW-GW) (FILL) *(140 lb hammer used for Sample 1)	SW-GW		0.00	1	HD	543,385/.1'		0.7/0.7		
1		Very dense (frozen), dark yellowish brown (10YR4/2), unstratified, dry, SAND and GRAVEL, (SW-GW) (FILL)	GW-SW		0.70	2	G	N/A		1.4/1.4		
2–4		Dense, dark yellowish brown (10YR4/2), unstratified, dry, SAND and GRAVEL, little silt, (SW-GW) (FILL or ALLUVIUM)	SW-GW		2.10	3	HD	30,21,17,14	31	1.8/2.0	■	
4–6		Compact, dark yellowish brown (10YR4/2), unstratified, dry, GRAVEL, some SAND, trace silt, (SW-GW) (ALLUVIUM or FILL)	SW-GW		4.10	4	HD	7,8,13,14	27	1.8/2.0	■	
6–8		6.1 FT TOTAL DEPTH OF BOREHOLE *Note: Unless specified, HD refers to a 4.0 inch OD split spoon advanced with a 300 lb. hammer with a 30 inch drop.			6.10							

DRILL RIG: CME-55

DRILLING CONTRACTOR: Hawley Brothers

DRILLER: Dan Hawley

Golder Associates

LOGGED: J. Wozniewicz

CHECKED: R. Burk

DATE: 19 JANUARY 1990

PROJECT: WINCO/ICPP/ID
PROJECT LOCATION: INEL
PROJECT NUMBER: 893-1195.020

RECORD OF BOREHOLE CPP-55-4

BORING DATE: 4 JANUARY 1990
BORING LOCATION: ICPP-55

SHEET: 1 OF 1
DATUM: MSL

DEPTH SCALE FEET	BORING METHOD	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV / DEPTH	SAMPLES: NUMBER	TYPE	BLOWS / 6 in	N	REC/ATT	PENETRATION RESISTANCE BLOWS/FT ■ (20 40 60 80) / WATER CONTENT, PERCENT Wp —○W— Wl	PIEZOMETER OR STANDPIPE INSTALLATION
0	4 INCH HOLLOW STEM AUGER (HSA)	Dense to very dense (frozen), dark yellowish brown (10YR4/2), unstratified, damp, SAND and GRAVEL (GW-SW) (FILL)			0.00							
1			GW-SW			1	G	N/A		2.0/2.0		
2		Very dense, dark yellowish brown (10YR4/2), unstratified, damp, SAND and fine GRAVEL, trace silt and clay, (GW-SW) (FILL or ALLUVIUM)			2.00							
3			GW-SW			2	HD	106,109,65,37	102	1.3/2.0		
4		Very dense, dark yellowish brown (10YR4/2), unstratified, damp, SAND and fine GRAVEL, trace silt and clay, (SW-GW) (FILL or ALLUVIUM)			4.00							
5			SW-GW			3	HD	15,23,36,38	74	1.5/2.0	■	
6		6.0 FT TOTAL DEPTH OF BOREHOLE Note: HD refers to a 4.0 inch OD split spoon advanced with a 140 lb. hammer with a 30 inch drop.			6.00							
7												
8												

DRILL RIG: CME-55
DRILLING CONTRACTOR: Hawley Brothers
DRILLER: Dan Hawley

Golder Associates

LOGGED: T. Griffin
CHECKED: R. Burk
DATE: 4 JANUARY 1990

RECORD OF BOREHOLE CPP-55-5

PROJECT: WINCO/ICPP/ID
PROJECT LOCATION: INEL
PROJECT NUMBER: 893-1195.020

BORING DATE: 20 DECEMBER 90
BORING LOCATION: ICPP-55

SHEET: 1 OF 1
DATUM: MSL

BORING METHOD: 4 INCH HOLLOW STEM AUGER (HSA)

DEPTH SCALE FEET	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV / DEPTH	SAMPLES: NUMBER	TYPE	BLOWS / 6 in	N	REC/ATT	PENETRATION RESISTANCE BLOWS/FT ■ (20, 40, 60, 80) / WATER CONTENT, PERCENT Wp ⊢—○W—⊣ Wl	PIEZOMETER OR STANDPIPE INSTALLATION
0	Very dense (frozen), dark yellowish brown (10YR4/2), unstratified, dry, SAND and fine GRAVEL (SW-GW) (FILL)	SW-GP		0.00	1	HD	124,166,258,233	491	0.3/2.0		
2	Dense, dark yellowish brown (10YR4/2), unstratified, dry, medium to coarse SAND and GRAVEL (SW-GP) (ALLUVIUM or FILL)	SW-GP		2.00	2	HD	14,15,14,17	31	2.0/2.0		
4	Very dense, dark yellowish brown (10YR4/2), unstratified, dry, medium to coarse SAND and fine GRAVEL (SW-GW) (ALLUVIUM or FILL) *(140 lb hammer used for Sample 3)	SW-GW		4.00	3	HD	10,16,20,36	56	1.0/2.0		
6	6.0 FT TOTAL DEPTH OF BOREHOLE *Note: Unless specified, HD refers to a 4.0 inch OD split spoon advanced with a 300 lb. hammer with a 30 inch drop.			6.00							
7											
8											

DRILL RIG: CME-55
DRILLING CONTRACTOR: Hawley Brothers
DRILLER: Dan Hawley

Golder Associates

LOGGED: J. Wozniewicz
CHECKED: R. Burk
DATE: 20 DECEMBER 90

PROJECT: WINCO/ICPP/ID
PROJECT LOCATION: INEL
PROJECT NUMBER: 893-1195

RECORD OF BOREHOLE CPP-55-5A

BORING DATE: 21 December 89
BORING LOCATION: ICPP-55

SHEET: 1 OF 1
DATUM: MSL

DEPTH SCALE FEET	BORING METHOD	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV / DEPTH	SAMPLES: NUMBER	TYPE	BLOWS / 6 in	N	REC/ATT	PENETRATION RESISTANCE BLOWS/FT / WATER CONTENT, PERCENT Wp W Wl	PIEZOMETER OR STANDPIPE INSTALLATION
0	4 INCH HOLLOW STEM AUGER (HSA)	Very dense (frozen), dark yellowish brown (10YR4/2), unstratified, SAND and GRAVEL, some Silt, (SW-GW) (FILL)			0.00							
1			SW-GW			1	G	N/A		2.0/2.0		
2		2.0 FT TOTAL DEPTH OF BOREHOLE			2.00							
3												
4		Refer to Record of Borehole CPP-55-5										
5												
6												
7												
8												

DRILL RIG: CME-55
DRILLING CONTRACTOR: Hawley Brothers
DRILLER: Dan Hawley

Golder Associates

LOGGED: J. Wozniewicz
CHECKED: R. Burk
DATE: 21 December 89

PROJECT: WINCO/ICPP/ID
PROJECT LOCATION: INEL
PROJECT NUMBER: 893-1195.020

RECORD OF BOREHOLE CPP-55-6

BORING DATE: 6 Febuary 1990
BORING LOCATION: ICPP-55

DATUM: MSL

BORING METHOD: 4 INCH HOLLOW STEM AUGER (HSA)

SOIL PROFILE

DEPTH (FEET)	DESCRIPTION	USCS	ELEV / DEPTH
0	Dense to very dense, dark yellowish brown (10YR4/2), unstratified, SAND and GRAVEL, trace silt, damp, (SW-GW) (FILL?)	SW-GW	0.00
5.8	5.8-6.0 ft: Firm, dark yellowish brown (10YR4/2), stratified, SILT, some sand and gravel, damp, (SM-GW) (ALLUVIUM)	SM-GW	5.80
6.0	Dense to very dense, dark yellowish brown (10YR4/2), unstratified, SAND and GRAVEL, trace silt, damp, (SW-GW) (ALLUVIUM)	SW-GW	6.00

SAMPLES

NUMBER	TYPE	BLOWS / 6 in	N	REC/ATT
1	G	N/A		2.0/2.0
2A	HD	80/.3		.3/.3
		Augered		
2B	HD	10/.2,45,60	105	1.0/1.2
3	HD	40,58,30,60	90	2.0/2.0
		Augered		
4	HD	18,27,20	47	1.5/1.5
5	HD	16,23,24,30	54	2.0/2.0
6	HD	16,30,35,45	80	2.0/2.0
7A	HD	108/.6		
7B	HD			
		Augered		
8	HD	45,68,10/.1		1.6/1.6

PENETRATION RESISTANCE BLOWS/FT ■ (20, 40, 60, 80)

WATER CONTENT, PERCENT: Wp ——○W—— Wl

PIEZOMETER OR STANDPIPE INSTALLATION

DRILL RIG: CME-55
DRILLING CONTRACTOR: Hawley Brothers
DRILLER: Dan Hawley

LOGGED: J. Wozniewicz
CHECKED: R. Burk
DATE: 8 febuary 1990

Golder Associates

PROJECT: WINCO/ICPP/ID
PROJECT LOCATION: INEL
PROJECT NUMBER: 893-1195.020

RECORD OF BOREHOLE CPP-55-6

BORING DATE: 6 Febuary 1990
BORING LOCATION: ICPP-55

SHEET: 2 OF 9
DATUM: MSL

DEPTH SCALE FEET	BORING METHOD	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV / DEPTH	SAMPLES: NUMBER	TYPE	BLOWS / 6 in	N	REC/ATT	PENETRATION RESISTANCE BLOWS/FT ■ 20 40 60 80 / WATER CONTENT, PERCENT Wp ⊢—○W—⊣ Wl	PIEZOMETER OR STANDPIPE INSTALLATION
16	4-INCH HOLLOW STEM AUGER (HSA)	Compact to very dense, dark yellowish brown (10YR4/2), unstratified, SAND and GRAVEL, trace silt, damp, (SW-GW) (ALLUVIUM)	SW-GW					Augered				
17						9	HD	46,76,85	163	.5/1.5		
18												
19		20.0 ft: wet soil at bottom of sample 10.				10	HD	45,76,91,92	183			
20						11	HD	64,115	179	0.8/1.4		
21								Augered				
22												
23						12	HD	30,42,30,33	63	.4/2.0		
24												
25						13	HD	18,45,58,63	121	.9/2.0		
26						14	HD	58,120		.0/1.0		
27								Augered				
28												
29						15	HD	25,77,84,10	94	2.0/2.0		
30												
31						16	HD	46,88,39,56	105	2.0/2.0		
32												

DRILL RIG: CME-55
DRILLING CONTRACTOR: Hawley Brothers
DRILLER: Dan Hawley

Golder Associates

LOGGED: J. Wozniewicz
CHECKED: R. Burk
DATE: 6 febuary 1990

PROJECT: WINCO/ICPP/ID
PROJECT LOCATION: INEL
PROJECT NUMBER: 893-1195.020

RECORD OF BOREHOLE CPP-55-6

BORING DATE: 6 Febuary 1990
BORING LOCATION: ICPP-55

DATUM: MSL

BORING METHOD: 4 INCH HOLLOW STEM AUGER (HSA)

DEPTH (FEET)	DESCRIPTION	USCS	ELEV / DEPTH	NUMBER	TYPE	BLOWS / 6 in	N	REC/ATT	PENETRATION RESISTANCE BLOWS/FT (20, 40, 60, 80) / WATER CONTENT, PERCENT	PIEZOMETER OR STANDPIPE INSTALLATION
32	Compact to very dense, dark yellowish brown (10YR4/2), unstratified, SAND and GRAVEL, trace silt, damp, (SW-GW) (ALLUVIUM)	SW-GW	32.00			Augered				
33				17	HD	35,50,45,62	107	2.0/2.0		
35				18	HD	41/.3,53,52	122	1.7/1.7		
36						Augered				
37				19	HD	27,52,38,25	62	2.0/2.0		
39	38.3-40.3 ft: wet to moist.			20	HD	21,34,31,27	58	2.0/2.0		
40	Firm to soft, dark yellowish brown (10YR4/2) to grayish orange (10YR7/4), stratified, silt to clayey silt, trace to some sand, slightly damp, (CL-ML)	CL-ML	40.30	21	HD	21,31,40,10	50	1.8/2.0		
42						Augered				
43				22	HD	34,78	112			
44	43.7 FT. ALLUVIUM/BASALT CONTACT		43.70							
45	Note: HD refers to 4.0 inch OD split spoon advanced with a 140 lb. hammer with a 30 inch drop.									

DRILL RIG: CME-55
DRILLING CONTRACTOR: Hawley Brothers
DRILLER: Dan Hawley

LOGGED: J. Wozniewicz
CHECKED: R. Burk
DATE: 6 febuary 1990

Golder Associates

RECORD OF DRILLHOLE CPP-55-6

PROJECT: WINCO/INEL1D
PROJECT NO: 893-1195.020
LOCATION: INEL

DRILLING DATE: 2/19-2/22, 1990
DRILL RIG: CME 55

DATUM: MSL
COORDINATES N:
E:
AZIMUTH:

COLLAR ELEV:
INCLINATION 90

J-Joint, F-Fault, S-Shear, B-Bedding, F-Foliation; PL-Planar, C-Curved, U-Undulating, ST-Stepped, I-Irregular; P-Polished, K-Slickensided, SM-Smooth, R-Rough, VR-V. Rough; FR-Fracture, CL-Clay Coating, SP-Sub-planar, IN-Clay infilling

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	ELEV / DEPTH (FT)	RUN NO.	CORE RECOVERY	RQD	FRACTURES PER FOOT	DIP w/t CORE AXIS	TYPE AND SURFACE DESCRIPTION	GRAPHIC LOG	HYDRAULIC CONDUCTIVITY cm/sec	NOTES WATER LEVELS INSTRUMENTATION
32–43	0.0-43.6 ft. - REFER TO SOILS LOG											
44–48	Fresh, medium dark gray (N4) to dark gray (N3), moderately vesicular, aphanitic, medium strong, BASALT			1	100				J,SP,SM,CL			
									J,SP,SM,CL Rubbly zone between fracture surfaces			

DEPTH SCALE: 1 INCH = 2 FEET
DRILLING CONTRACTOR: HAWLEY BROTHERS
DRILLER: D. HAWLEY

LOGGED: J. WOZNIEWICZ/T. GRIFFIN
CHECKED: R. Burk
DATE: 19 FEBUARY 1990

Golder Associates

RECORD OF DRILLHOLE CPP-55-6

Sheet 5 of 9

PROJECT: WINCO/INEL/ID
PROJECT NO: 883-1195.020
LOCATION: INEL

DRILLING DATE: 2/19-2/22, 1990
DRILL RIG: CME 55

DATUM: MSL
COORDINATES N:
AZIMUTH:

COLLAR ELEV:
E:
INCLINATION: 90

Legend: J-Joint, F-Fault, S-Shear, B-Bedding, F-Foliation; PL-Planar, C-Curved, U-Undulating, ST-Stepped, I-Irregular; P-Polished, K-Slickensided, SM-Smooth, R-Rough, VR-V. Rough; FR-Fracture, CL-Clay Coating, SP-Sub-planar, IN-Clay Infilling

DEPTH (FEET)	DESCRIPTION	ELEV / DEPTH (FT)	RUN NO.	CORE RECOVERY	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	NOTES / WATER LEVELS / INSTRUMENTATION
48	Fresh, medium dark gray (N4) to dark gray (N3), moderately vesicular, aphanitic, medium strong, BASALT		1	100	J,SP,SM,CL	
					48.7-48.9 Highly fractured zone with clay coatings	
49		48.90			J,SP,SM,CL	
50					J,SP-I,SM,CL	
51			2	100		
52					J,SP,SM,CL	
53					J,SP,SM,CL	
54		53.90				
55					54.8-55.9 Rubble zone with clay coatings	
56			3	94	J,SP-I,R	
					J,I,SM,CL	
57					56.7-56.9 Rubble zone with clay coatings	
					J,SP,SM,CL	
					J,PL,SM,CL	
58					J,PL,SM,CL	
					J,SP-I,SM-R,CL	
59	Fresh, slightly to moderately vesicular blackish red (5R2/2) to grayish red (5R4/2), aphanitic, medium strong, BASALT	58.90			Rubble zone	
60					58.9-59.4	
61					J,SP	Radiation levels 5000 counts/min at 60.7 ft.*
			4	100		
62					J,SP,SM	
					J,I	
63					J,I,R	
64		63.90				

DEPTH SCALE: 1 INCH = 2 FEET
DRILLING CONTRACTOR: HAWLEY BROTHERS
DRILLER: D. HAWLEY

LOGGED: J. WOZNIEWICZ/T. GRIFFIN
CHECKED: R. Burk
DATE: 19 FEBUARY 1990

Golder Associates

RECORD OF DRILLHOLE CPP-55-6

PROJECT: WINCO/INEL/ID
PROJECT NO: 893-1195.020
LOCATION: INEL

DRILLING DATE: 2/19-2/22 1990
DRILL RIG: CME 55

DATUM: MSL
COORDINATES N:
E.
AZIMUTH:

COLLAR ELEV:
INCLINATION: 90

J-Joint, F-Fault, S-Shear, B-Bedding, F-Foliation; PL-Planar, C-Curved, U-Undulating, ST-Stepped, I-Irregular; P-Polished, K-Slickensided, SM-Smooth, R-Rough, VR-V. Rough; FR-Fracture, CL-Clay Coating, SP-Sub-planar, IN-Clay infilling

DEPTH SCALE (FEET)	ROCK TYPE DESCRIPTION	ELEV DEPTH (FT)	RUN NO.	CORE RECOVERY	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	NOTES WATER LEVELS INSTRUMENTATION
64	Fresh, slightly vesicular, dark gray (N3), aphanitic, medium strong, BASALT				J,SP,SM,CL	
65					J,SP,SM	
66			5	100	J,SP,SM	
67					J,SP,SM	
68						Radiation level 3000 counts/min at 68 ft.*
69	Fresh, vesicular, brownish gray (5YR2/1), aphanitic, medium strong, BASALT	68.90			Rubble zone 69.3-70.7	
70						
71			6	84	Rubble zone 71.7-71.9	Radiation level 1500 counts/min at 71 ft.**
72					J,SP,R J,C,SM	
73					J,SP J,PL,SM,IN	
74	Slightly weathered, vesicular, moderate orange pink (10YR7/4) to pale red (5YR6/2), aphanitic, weak to medium strong, rubbly BASALT	74.10	7	0		
75						Radiation level 20000 counts/min at 75 ft.*
76	Fresh, massive, vesicular, grayish red (5R4/2) to dusky brown (5YR2/2) at bottom of run 8, aphanitic, BASALT	75.60			J,SP,R,IN J,SP,R,IN J,SP,R,IN	
77			8	85	J,SP-C,R,IN	
78					J,U,R,IN J,SP,R	
79		79.00	9	90		
80						

DEPTH SCALE: 1 INCH=2 FEET
DRILLING CONTRACTOR: HAWLEY BROTHERS
DRILLER: D. HAWLEY

LOGGED: J. WOZNIEWICZ/T. GRIFFIN
CHECKED: R. Burk
DATE: 19 FEBUARY 1990

Golder Associates

RECORD OF DRILLHOLE CPP-55-6

PROJECT: WINCO/INEL/ID
PROJECT NO: 893-1195.020
LOCATION: INEL

DRILLING DATE: 2/19-2/22, 1990
DRILL RIG: CME 55

DATUM: MSL
COORDINATES N:
AZIMUTH:

COLLAR ELEV:
E:
INCLINATION: 90

Discontinuity codes: J-Joint, F-Fault, S-Shear, B-Bedding, F-Foliation; PL-Planar, C-Curved, U-Undulating, ST-Stepped, I-Irregular; P-Polished, K-Slickensided, SM-Smooth, R-Rough, VR-V. Rough; FR-Fracture, CL-Clay Coating, SP-Sub-planar, IN-Clay Infilling

Depth (ft)	Rock Type Description	Elev/Depth (ft)	Run No.	Core Recovery	Type and Surface Description	Notes / Water Levels / Instrumentation
80	Fresh, massive, vesicular, dusky brown (5YR2/2), aphanitic, BASALT					
81					J,SP,R	
					J,P,R	
82			9	90	J,SP,R,IN	
83					J,SP,R	Radiation level 1000 counts/min at 83 ft.*
					J,SP,R,IN	
					J,U,R	
					J,SP,R	
84	Fresh, slightly vesicular, medium dark gray (N4), aphanitic, medium strong, BASALT	84.00			J,PL,SM,IN	
			10	100	J,SP,R,IN	
85					J,PL,SM,IN	Radiation level 200 counts/min at 85 ft.*
		85.60				
86					J,SP,SM	
					J,PL-U,SM,IN	
					J,C,SM,IN	
87					J,I	
			11	97	J,PL,SM,IN	
88					J,SP,SM,IN	Radiation level 250 counts/min at 88 ft.*
89		89.20				
90						
91						
92			12	100	J,U-I,R,IN	Radiation level 500 counts/min at 92 ft.**
					J,U,SM	
93					J,PL,SM	
94		94.30				Radiation level 1000 counts/min at 94 ft.*
95					J,U,SM,IN	
			13	100		
96						

DEPTH SCALE: 1 INCH = 2 FEET
DRILLING CONTRACTOR: HAWLEY BROTHERS
DRILLER: D. HAWLEY

LOGGED: J. WOZNIEWICZ/T. GRIFFIN
CHECKED: P. Burk
DATE: 19 FEBUARY 1990

Golder Associates

RECORD OF DRILLHOLE CPP-55-6

PROJECT: WINCO/INEL/ID
PROJECT NO: 893-1195.020
LOCATION: INEL

DRILLING DATE: 2/19-2/22, 1990
DRILL RIG: CME 55

DATUM: MSL
COORDINATES N:
E:
AZIMUTH:

COLLAR ELEV:
INCLINATION: 90

Legend: J-Joint, F-Fault, S-Shear, B-Bedding, F-Foliation; PL-Planar, C-Curved, U-Undulating, ST-Stepped, I-Irregular; P-Polished, K-Slickensided, SM-Smooth, R-Rough, VR-V. Rough; FR-Fracture, CL-Clay Coating, SP-Sub-planar, IN-Clay Infilling

Depth (ft)	Description	Elev / Depth (ft)	Run No.	Core Recovery	Discontinuity type and surface description	Notes / Water levels / Instrumentation
96	Fresh, slightly vesicular, medium dark grey (N4), aphanitic, medium strong, BASALT		13	100	J,U,SM-R,IN	
99.3		99.30	14	100	J,SP,SM-R,IN	
103.4					J,I,SM-R,IN	Radiation level 180 counts/min at 104 ft.*
104.3		104.30	15	100	J,PL,SM,IN	
105.5					J,PL,SM	
107.3					J,SP,R,IN	
109.3		109.30	16	100		

DEPTH SCALE 1 INCH=2 FEET
DRILLING CONTRACTOR: HAWLEY BROTHERS
DRILLER D. HAWLEY

LOGGED: J. WOZNIEWICZ/T. GRIFFIN
CHECKED: R. Burk
DATE: 19 FEBUARY 1990

Golder Associates

RECORD OF DRILLHOLE CPP-55-6

Sheet 9 of 9

PROJECT: WINCO/INEL/ID
PROJECT NO: 893-1195.020
LOCATION: INEL

DRILLING DATE: 2/19-2/22, 1990
DRILL RIG: CME 55

DATUM: MSL
COORDINATES N:
AZIMUTH:

COLLAR ELEV:
E:
INCLINATION: 90

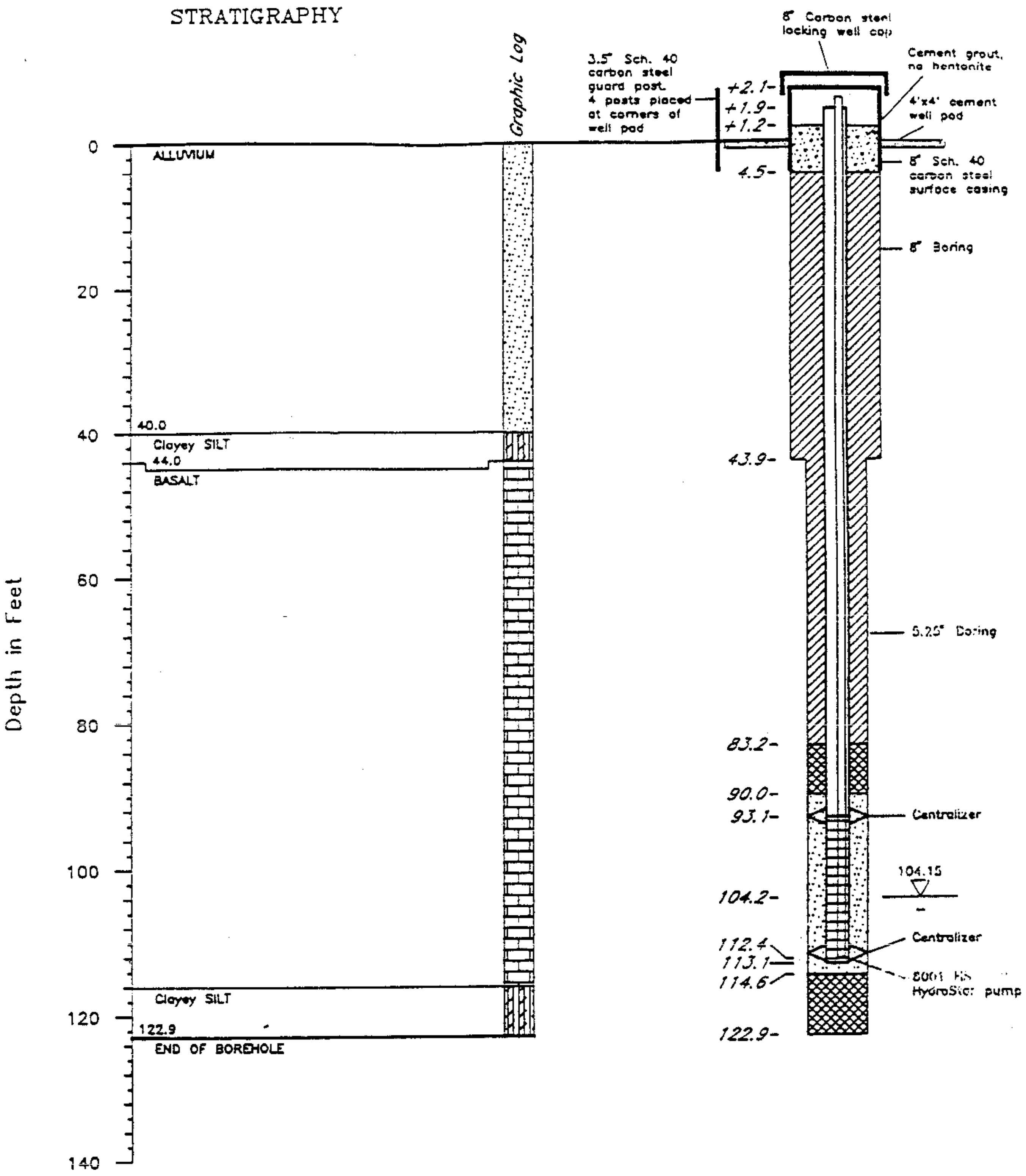
Legend: J-Joint, F-Fault, S-Shear, B-Bedding, F-Foliation; PL-Planar, C-Curved, U-Undulating, ST-Stepped, I-Irregular; P-Polished, K-Slickensided, SM-Smooth, R-Rough, VR-V. Rough; FR-Fracture, CL-Clay Coating, SP-Sub-planar, IN-Clay infilling

DEPTH SCALE (FEET)	DESCRIPTION	ELEV / DEPTH (FT)	RUN NO.	CORE RECOVERY	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	NOTES WATER LEVELS INSTRUMENTATION
112	Fresh, slightly vesicular, medium dark gray (N4), aphanitic, medium strong, BASALT					
113			16	100	J,PL-U,SM,IN	
114		114.30				Radiation level 4500 counts/min at 114 ft.*
115			17	100		
116		116.10			J,SP,SM,IN	Radiation level 1500 counts/min at 116 ft.*
					J,SP,R,IN	
117	Fresh, moderately vesicular, medium dark gray (N4), aphanitic, medium strong, BASALT		18	100	J,I,SM-R,IN	
118	Moderate reddish brown (10YR4/6), non-stratified, damp, fine SAND, little silt and clay, trace medium to coarse Sand (SM) (SEDIMENTARY INTERBED)					
119	Stiff to hard, moderate reddish brown (10YR4/6), non-stratified, damp, CLAYEY SILT to SILTY CLAY (CL-ML) (SEDIMENTARY INTERBED)	119.30				
120						
121			19	42		*Note: All Radiation monitoring conducted by WINCO.
122						
123	Drillhole terminated at 122.9 ft.	122.90				** Radiation survey performed through lexan tube.
124						
125						
126						
127						
128						

DEPTH SCALE: 1 INCH = 2 FEET
DRILLING CONTRACTOR: HAWLEY BROTHERS
DRILLER: D. HAWLEY

LOGGED: J. WOZNIEWICZ/T. GRIFFIN
CHECKED: R. Burk
DATE: 19 FEBUARY 1990

Golder Associates



WELL COMPLETION LEGEND:

- Cement Grout 3–5% Bentonite
- 1/4" Volclay Tablets
- 10–20 Silica Sand
- Water Level
- 2" Stainless Steel Well Casing
- 2" S.S. Well Screen 0.020–slot

NOT TO SCALE

Date: 4/23/90
Geologist: SJB
Drilling Contractor: HAWLEY BROS.
Drill Method: CP CORE
Sampling Method: –

FIGURE 1
SHEET 1 OF 1

WELL **CPP55-06**
RECORD OF DRILLHOLE
INEL

PROJECT NO 893-1195.010 DWG NO 34053 DATE 5/16/90 DRAWN DJH APPROVED TN

PROJECT: WINCO/ICPP/ID
PROJECT LOCATION: INEL
PROJECT NUMBER: 893-1195.020

RECORD OF BOREHOLE CPP-55-7

BORING DATE: 21 DECEMBER 90
BORING LOCATION: ICPP-55

SHEET: 1 OF 1
DATUM: MSL

DEPTH SCALE FEET	BORING METHOD	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV / DEPTH	SAMPLES: NUMBER	TYPE	BLOWS / 6 in	N	REC/ATT	PENETRATION RESISTANCE BLOWS/FT ■ 20 40 60 80; WATER CONTENT, PERCENT Wp —○W— Wl	PIEZOMETER OR STANDPIPE INSTALLATION
0	4 INCH HOLLOW STEM AUGER (HSA)	Very dense (frozen), moderate brown (5YR4/4), unstratified, dry, SAND and GRAVEL, some SILT, (SW-GW) (ALLUVIUM or FILL)			0.00							
1			SW-GW			1	G	N/A		2.0/2.0		
2		Very dense, dark yellowish brown (10YR4/2) to moderate brown(5YR4/4), unstratified, dry, medium to coarse SAND and GRAVEL, little silt, (SW-GW) (ALLUVIUM or FILL)			2.00							
3			SW-GW			2	HD	36,57,55,47	102	1.8/2.0		
4		Very dense, moderate brown (5YR3/4), unstratified, dry, medium to coarse SAND and GRAVEL, trace silt, (SW-GW) (ALLUVIUM or FILL)			4.00							
5			SW-GW			3	HD	21,32,27,32	59	1.0/2.0	■	
6		6.0 FT TOTAL DEPTH OF BOREHOLE Note: HD refers to a 4.0 inch OD split spoon advanced with a 140 lb. hammer with a 30 inch drop.			6.00							
7												
8												

DRILL RIG: CME-55
DRILLING CONTRACTOR: Hawley Brothers
DRILLER: Dan Hawley

Golder Associates

LOGGED: J. Wozniewicz
CHECKED: R. Burk
DATE: 20 DECEMBER 90

PROJECT: WINCO/ICPP/ID
PROJECT LOCATION: INEL
PROJECT NUMBER: 893-1195.020

RECORD OF BOREHOLE CPP-55-8

BORING DATE: 3 JANUARY 1990
BORING LOCATION: ICPP-55

SHEET: 1 OF 1
DATUM: MSL

DEPTH SCALE FEET	BORING METHOD	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV / DEPTH	SAMPLES: NUMBER	TYPE	BLOWS / 6 in	N	REC/ATT	PENETRATION RESISTANCE BLOWS/FT ■ (20 40 60 80) / WATER CONTENT, PERCENT Wp W Wl	PIEZOMETER OR STANDPIPE INSTALLATION
0	4-INCH HOLLOW STEM AUGER (HSA)	Very dense (frozen), dark yellowish brown (10YR4/2), unstratified, GRAVEL, some SAND, trace silt, (SW-GW) (FILL)	SW-GW		0.00							
1		Dense, dark yellowish brown (10YR4/2), unstratified, damp, GRAVEL and SAND, trace silt, (SW-GW) (ALLUVIUM or FILL)	SW-GW		1.00	1	G	N/A		2.0/2.0		
2		Very dense, dark yellowish brown (10YR4/2), unstratified, damp, SAND and fine to medium GRAVEL, trace silt, (SW-GW) (ALLUVIUM or FILL)	SW-GW		2.00							
3						2	HD	15,22,24,36	60	1.2/2.0	■	
4		Very Dense, dark yellowish brown (10YR4/2), unstratified, damp, SAND, some GRAVEL, (SW-GW) (ALLUVIUM or FILL)	SW-GW		4.00							
5						3	HD	7,23,25,28	53	1.0/2.0	■	
6		6.0 FT TOTAL DEPTH OF BOREHOLE Note: HD refers to a 4.0 inch OD split spoon advanced with a 140 lb. hammer with a 30 inch drop.			6.00							
7												
8												

DRILL RIG: CME-55
DRILLING CONTRACTOR: Hawley Brothers
DRILLER: Dan Hawley

Golder Associates

LOGGED: S Brandenberger
CHECKED: R. Burk
DATE: 3 JANUARY 1990

PROJECT: WINCO/ICPP/ID
PROJECT LOCATION: INEL
PROJECT NUMBER: 893-1195.020

RECORD OF BOREHOLE CPP-55-9

BORING DATE: 3 JANUARY 1990
BORING LOCATION: ICPP-55

SHEET: 1 OF 1
DATUM: MSL

DEPTH SCALE FEET	BORING METHOD	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV / DEPTH	SAMPLES: NUMBER	TYPE	BLOWS / 6 in	N	REC/ATT	PENETRATION RESISTANCE BLOWS/FT ■ (20 40 60 80) / WATER CONTENT, PERCENT Wp —○W— Wl	PIEZOMETER OR STANDPIPE INSTALLATION
0	4-INCH HOLLOW STEM AUGER (HSA)	Very dense (frozen), dark yellowish brown (10YR4/2), unstratified, damp, GRAVEL, some Sand, (GW) (FILL)	GW		0.00	1	G	N/A		2.0/2.0		
2		Very dense, dark yellowish brown (10YR4/2), unstratified, damp, SAND and fine to medium GRAVEL (SW-GW) (ALLUVIUM or FILL)	SW-GW		2.00	2	HD	20,27,32,33	65	1.2/2.0	■	
4		Very dense, brownish gray (5YR4/2), unstratified, damp, SAND and fine to medium GRAVEL (SW-GW) (ALLUVIUM or FILL)	SW-GW		4.00	3	HD	15,27,28,37	65	1.0/2.0	■	
6		6.0 FT TOTAL DEPTH OF BOREHOLE Note: HD refers to a 4.0 inch OD split spoon advanced with a 140 lb. hammer with a 30 inch drop.			6.00							

DRILL RIG: CME-55
DRILLING CONTRACTOR: Hawley Brothers
DRILLER: Dan Hawley

Golder Associates

LOGGED: S Brandenberger
CHECKED: R. Burk
DATE: 20 DECEMBER 90

PROJECT: WINCO/ICPP/ID

PROJECT LOCATION: INEL

PROJECT NUMBER: 893-1195.020

RECORD OF BOREHOLE CPP-55-10

BORING DATE: 22 DECEMBER 90

BORING LOCATION: ICPP-55

SHEET: 1 OF 1

DATUM: MSL

DEPTH SCALE FEET	BORING METHOD	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV / DEPTH	SAMPLES NUMBER	TYPE	BLOWS / 6 in	N	REC/ATT	PENETRATION RESISTANCE BLOWS/FT ■ 20 40 60 80 / WATER CONTENT, PERCENT Wp ⊢—○W—⊣ Wl	PIEZOMETER OR STANDPIPE INSTALLATION
0	4 INCH HOLLOW STEM AUGER (HSA)	Very dense (frozen), dark yellowish brown (10YR4/2), unstratified, SAND and fine GRAVEL, some SILT, (FILL)			0.00							
1			SW-GM			1	G	N/A		2.0/2.0		
2		Very dense, dark yellowish brown (10YR4/2), unstratified, GRAVEL and fine to medium SAND, trace silt, (SW-GW) (ALLUVIUM or FILL)			2.00							
3			SW-GW			2	HD	16,36,30,31	61	1.7/2.0		
4		Dense, grayish brown (5YR3/2) to moderate brown (5YR3/4), unstratified, dry, GRAVEL and medium to coarse SAND, trace silt, (SW-GW) (ALLUVIUM or FILL)			4.00							
5			SW-GW			3	HD	17,24,21,24	45	1.8/2.0		
6		6.0 FT TOTAL DEPTH OF BOREHOLE Note: HD refers to a 4.0 inch OD split spoon advanced with a 140 lb. hammer with a 30 inch drop.			6.00							
7												
8												

DRILL RIG: CME-55

DRILLING CONTRACTOR: Hawley Brothers

DRILLER: Dan Hawley

Golder Associates

LOGGED: J. Wozniewicz

CHECKED: R. Burk

DATE: 22 DECEMBER 90

PROJECT: WINCO/ICPP/ID
PROJECT LOCATION: INEL
PROJECT NUMBER: 893-1195.020

RECORD OF BOREHOLE CPP-55-11

BORING DATE: 22 DECEMBER 90
BORING LOCATION: ICPP-55

SHEET: 1 OF 1
DATUM: MSL

DEPTH SCALE FEET	BORING METHOD	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV / DEPTH	SAMPLES NUMBER	TYPE	BLOWS / 6 in	N	REC/ATT	PENETRATION RESISTANCE BLOWS/FT ■ (20 40 60 80) / WATER CONTENT, PERCENT Wp —○W— Wl	PIEZOMETER OR STANDPIPE INSTALLATION
0	4 INCH HOLLOW STEM AUGER (HSA)	Very dense (frozen), moderate brown (5YR4/4), unstratified, damp, SAND and GRAVEL, little silt, (SW-GW) (FILL)	SW-GW		0.00	1	G	N/A		2.0/2.0		
2		Dense, moderate yellowish brown (10YR5/4), unstratified, damp, SAND and fine GRAVEL, some Silt, (SW-GM) (ALLUVIUM or FILL)	SW-GM		2.00	2	HD	9,17,19,12	31	1.8/2.0	■	
3		Dense, moderate yellowish brown (10YR5/4), unstratified, damp, GRAVEL and medium to coarse SAND, trace silt, (SW-GW) (ALLUVIUM or FILL)	SW-GW		3.00							
4		Compact, grayish brown (5YR3/2), unstratified, damp, medium to coarse SAND, little fine Gravel, (SW) (ALLUVIUM or FILL)	SW		4.00	3	HD	7,11,12,17	29	1.6/2.0	■	
6		6.0 FT TOTAL DEPTH OF BOREHOLE			6.00							

Note: HD refers to a 4.0 inch OD split spoon advanced with a 140 lb. hammer with a 30 inch drop.

DRILL RIG: CME-55
DRILLING CONTRACTOR: Hawley Brothers
DRILLER: Dan Hawley

Golder Associates

LOGGED: J Wozniewicz
CHECKED: R. Burk
DATE: 22 DECEMBER 90

APPENDIX C

QUALITY ASSURANCE SAMPLE ANALYSIS RESULTS

Table C.1

Organic Trip Blank Analysis Results

Land Disposal Unit CPP-55

Compound	Range of Values, ug/L
Acetone	9 to 49
Methylene Chloride	4

Table C.2 Equipment Blank Analysis Results Land Disposal Unit CPP-55			
Sample ID:	2186-(3,4,5)	2218-(14,15,16)	405-002
Date Sampled:	12/19/89	01/04/90	02/22/90
Iron, ug/L	82.1	<50.0	NA[1]

[1]NA indicates sample was not analyzed for the indicated parameter.

Table C.3

Field Blank Analysis Results
(Deionized Water from Building CPP-609)

Lab Sample ID:	2202-(16,17,18)	2281-(4,5)	2286-03
Date Sampled:	12/22/89	02/08/90	02/08/90
Iron, ug/L	50.7	<50.0	NA[1]
Trichloroethene, ug/L	<5	<5	2 J[2]

[1]NA indicates the sample was not analyzed for the respective compound/analyte.

[2]J indicates the compound was detected at an estimated concentration indicating the sample result may be less than the contract required detection limit but greater than zero.

Table C.4

Field Duplicate Analysis Results, (mg/Kg)
Land Disposal Unit CPP-55

Laboratory Sample ID:	2191-(1,2,3)	2191-(4,5,6)	
Golder Sample ID:	CPP55-03-TX-3-1 CPP55-03-V2-3-2 CPP55-03-V3-3-3	CPP55-03-TX-3-4-FD CPP55-03-V2-3-5-FD CPP55-03-V3-3-6-FD	
Borehole Location:	CPP55-03	CPP55-03	
Sample Depth, feet:	2' TO 4'	2' TO 4'	
Date sampled:	12/20/89	12/20/89	%RPD[1]
Arsenic	4.9	5.3	7.8
Barium	120	118	1.7
Cadmium	<1.0	<1.0	NC[2]
Chromium	24.4	29.6	19.3
Iron	12,800	13,000	1.6
Lead	7.8	7.4	5.3
Mercury	0.45	0.44	2.2
Nickel	17.0	12.8	28.2
Selenium	<0.54	<0.52	NC[2]
Silver	<2.0	<2.0	NC[2]

[1]Relative percent difference (RPD%) equals the absolute value of the difference between two measurements divided by the average of the two measurements multiplied by 100. For soil matrices a target goal for %RPD is usually 35% for samples that exhibit results at least greater than 5 times the sample detection limit.

[2]NC indicates the RPD cannot be calculated because of one or more result at or below the sample detection limit.

Table C.4 Continued

Field Duplicate Analysis Results, (mg/Kg)
Land Disposal Unit CPP-55

Laboratory Sample ID:	2218-(28,29,30)	2218-(31,32,33)	
Golder Sample ID:	CPP55-09-TX-6-9 CPP55-09-V2-6-10 CPP55-09-V3-9-11	CPP55-09-TX-6-12-FD CPP55-09-V2-6-13-FD CPP55-09-V3-6-14-FD	
Borehole Location:	CPP55-09	CPP55-09	
Sample Depth, feet:	4' to 6'	4' to 6'	
Date sampled:	01/03/90	01/03/90	%RPD[1]
Arsenic	6.2	6.8	9.0
Barium	108	96.4	11.4
Cadmium	<1.0	<0.99	NC[2]
Chromium	17.9	14.6	20.3
Iron	12,100	10,400	15.1
Lead	7.2	6.4	11.8
Mercury	<0.05	<0.05	NC[2]
Nickel	18.1	14.8	20.1
Selenium	<0.57	<0.60	NC[2]
Silver	<2.0	<2.0	NC[2]

[1]Relative percent difference (RPD%) equals the absolute value of the difference between two measurements divided by the average of the two measurements multiplied by 100. For soil matrices a target goal for %RPD is usually 35% for samples that exhibit results at least greater than 5 times the sample detection limit.

[2]NC indicates the RPD cannot be calculated because of one or more result at or below the sample detection limit.

Table C.5 - Blind Sample Analysis Results Land Disposal Unit CPP-55			
Laboratory Sample ID:	2218-(1,2,3)		
Golder Sample ID:	CPP55-04-V2-2-FB		
Date sampled:	01/04/90		
Compound/Analyte	Reported Value, ug/L	True Value ug/L	Percent Recovery[1]
Methylene Chloride	20	20.8	96
1,1-Dichloroethane	18	20	90
Chloroform	20	20.2	99
1,1,1-Trichloroethane	18	20.2	89
Bromodichloromethane	19	20.2	94
Trichloroethene	18	20.4	88
Dibromochloromethane	19	20.4	93
Benzene	20	20.6	97
Bromoform	17	20	85
1,1,2,2-Tetrachloroethane	17	20	85
Toluene	19	20.6	92
1,2-Dichlorobenzene	17	20	85
Arsenic	4450	5000	89
Selenium	920	1000	92

[1]Percent recovery is calculated by dividing the reported value by the true value and multiplying by 100. For water matrices the target percent recovery is typically 80 to 120 percent.

Table C.6

Decontamination Rinseate Analysis Results
Land Disposal Unit CPP-55

Laboratory Sample ID:	2191-(11,12)	2218-(17,18,19)
Golder Sample ID:	CPP55-DCW-TX-11 CPP55-DCW-MH-12	CPP55-02-TX-17-DCW CPP55-02-V2-18-DCW CPP55-02-V3-19-DCW
Date Sampled:	12/20/89	01/04/90
Analyte/Compound	Result, ug/L (except where noted)	
Mineral Spirits[1]	NA[2]	81 mg/L
Methanol	30 mg/L	3.4 mg/L
Arsenic	7.0	16.0
Barium	215	1,800
Cadmium	<5.0	<5.0
Chromium	33.5	96.2
Iron	17,800	52,800
Lead	120	260
Mercury	0.32	<0.10
Nickel	33.6	128
Selenium	<3.0	<3.0
Silver	<10.0	<10.0

[1]High (boiling point) petroleum hydrocarbons quantitated against mineral spirits. This is not a definitive identification. Any hydrocarbon occuring within the approximate boiling range of mineral spirits standard is characterized as, and quantitated as, mineral spirits.

[2]NA signifies analyte/compound was not analyzed for in the respective sample.

APPENDIX D

BOREHOLE CPP-55-06 ANALYSES

TABLE D.1

LIST OF ANALYTES/COMPOUNDS ANALYZED (APPENDIX VIII COMPOUNDS, CLP ORGANIC COMPOUNDS, CLP INORGANIC ANALYTES AND RADIONUCLIDES)

INORGANIC ANALYTES

Aluminum
Antimony
Arsenic
Barium
Beryllium
Cadmium
Calcium
Chromium
Cobalt
Copper
Cyanide
Iron
Lead
Magnesium
Manganese
Mercury
Nickel
Potassium
Selenium
Silver
Sodium
Sulfide
Thallium
Tin
Vanadium
Zin

RADIONUCLIDES

Americium 241
Plutonium 238
Neptunium
Antimony 125
Cobalt 60 & 58
Iodine 129
Cerium 144
Ruthenium 103 & 106
Cesium 134 & 137
Strontium 90
Yttrium 90
Uranium 234, 235 & 238

VOLATILE ORGANICS

Acetone
Acetonitrile
Acrolein
Acrylonitrile
Allyl Chloride
Benzene
Bromoacetone
Bromoform
Carbon Disulfide
Carbon Tetrachloride
Chlorobenzene
1-Chloro-2,3-epoxypropane
Chlorodibromomethane
2-Chloroethylvinyl ether
Chloroethane
Chloromethyl methyl ether
Chloroform
Chloroprene
Crotonaldehyde
1,2-Dibromo-3-chloropropane
1,2-Dibromoethane
Dibromomethane
trans-1,4-Dichloro-2-butene
Dichlorobromomethane
Dichlorodifluoromethane
1,1-Dichloroethane
1,2-Dichloroethane
1,2-Trans-dichloroethylene
1,1-Dichloroethylene
1,3-Dichloropropane
1,2-Dichloropropane
2,3-Dichloropropene
cis-1,3-Dichloropropylene
trans-1,3-Dichloropropylene
1,2,3,4-Diepoxybutane
N,N-Diethylhydrazine
1,4-Dioxane
Ethylbenzene
Ethylcyanide
Freon TF
Formaldehyde
2-Hexanone
Iodomethane
Isobutyl alcohol
Methyl bromide
Methyl chloride
Methacrylonitrile
Methyl ethyl ketone
Methyl hydrazine
4-Methyl-2-pentanone
Methylene Chloride
Paraldehyde
Pentachloroethane
Styrene
1,1,1,2-Tetrachloroethane
1,1,2,2-Tetrachloroethane
Tetrachloroethylene
Tetranitromethane
Toluene
1,1,1-Trichloroethane
1,1,2-Trichloroethane
Trichloromethanethiol
Trichloroethylene
Trichlorofluoromethane
1,1,2-Trichloropropane
1,2,2-Trichloropropane
1,2,3-Trichloropropane
Vinyl Acetate
Vinyl Chloride
Xylene (total)

SEMI-VOLATILE ORGANICS

Acenaphthene
Acenaphthylene
Acetophenone
2-Acetylaminofluorene
Aflatoxins, Total
4-Aminobiphenyl
5-(Aminomethyl)-3-isoxazolol
Aniline
Anthracene
Aramite
Auramine
Benzo(c)acridine
Benzo(a)anthracene

Benzyl Chloride
Benzoic Acid
Benzyl Alcohol
Benzenethiol
Benzo(b)fluranthene
Benzo(j)fluoranthene
Benzo(k)fluoranthene
Benzo(g,h,i)perylene
Benzo(a)pyrene
Benzotrichloride
p-Benzoquinone
bis(2-Chloroethyl)ether
bis(2-Chloroethoxy)methae
bis(2-Chloroisopropyl)ether
bis(2-Ethylhexyl)phthalate
4-Bromophenyl-phenylether
Brucine
2-Butanone Peroxide
Butyl Benzyl Phthalate
2-sec-Butyl-4,6-dinitrophenol
Chloronaphazine
1-Chloronaphathalene
2-Chloronaphthalene
2-Chlorophenol
4-Chlorophenylphenylether
3-Chloropropionitrile
Chrysene
p-Chloroaniline
p-Chloro-m-cresol
o-Cresol
m-Cresol
p-Cresol
2-Cyclohexyl-4,6-dinitrophenol
Dibenzo(a,h)anthracene
Dibenzo(a,h)acridine
Dibenzo(a,j)acridine
Dibenzo(a,e)pyrene
Dibenzo(a,h)pyrene
Dibenzofuran
Dibenzo(a,i)pyrene
7H-Dibenzo(c,g)carbazole
1,2-Dichlorobenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene
3,3-Dichlorobenzidine
Dichloromethylbenzene
2,4-Dichlorophenol
2,6-Dichlorophenol
Dichlorophenylarsine
Diethylphthalate
Dihydrosafrole
Diisopropylfluorophosphate
p-Dimethylaminoazobenzene
3,3'-Dimethylbenzidine
7,12-Dimethylbenzo(a)anthcene
1,1-Dimethylhydrazine
1,2-Dimethylhydrazine
a-a-Dimethylphenethylamine
Dimethyl Phthalate
2,4-Dimethylphenol
Di-n-butyl Phthalate
2,4-Dinitrophenol
Dimethyl Sulfate
m-Dinitrobenzene
4,6-Dinotro-o-cresol
2,4-Dinitrotoluene
2,6-Dinitrotoluene
Di-n-octyl Phthalate
Diphenylamine
1,2-Diphenylhydrazine
2,4-Dithiobiuret
Endothal
Ethyl Methacrylate
Ethyl Methanesulfonate
Fluoranthene
Fluorene
Formic Acid
Hexachlorobenzene
Hexachlorobutadiene
Hexachlorocyclopentadiene
Hexachloroethane
Hexachlorophene
Hexachloropropene
Hexaethyltetraphosphate
Hydrazine
Indeno(1,2,3-cd)pyrene
Isophorone
Isosafrole
Maleic Anhydride
Melphalan
Methyapyrilene
3-Methylcholanthrene
Methyl Methacrylate
4,4-Methylenebis(2-chloroanilin)
2-Methyllactonitrile
Methyl Methanesulfonate
N-Methyl-N-nitroso-N-nitrogua
2-Methylnaphthalene
Methylthiouracil
Naphthalene
1,4-Naphthoquinoline
1-Naphthylamine
2-Naphthylamine
p-Nitroaniline
m-Nitroaniline
o-Nitroaniline
Nitrobenzene
2-Nitrophenol
4-Nitrophenol
N-Nitrosodi-n-butylamine
N-Nitrosodiethanolamine
N-Nitrosodiethylamine
N-Nitrosodimethylamine
N-Nitrosomethylethylamine
N-Nitroso-n-methylurethane
N-Nitrosomethylvinylamine
N-Nitrosomorpholine
N-Nitrosonornicotine
N-Nitrosodi-n-propylamine
N-Nitroquinoline-n-oxide
N-Nitrosospiperidine
N-Nitrosopyrrolidine
N-Nitrosodiphenylamine
N-Nitrososarcosine
5-Nitro-o-toluidine
Octamethylpyrophosphoramide
Paraoxon
Pentachlorobenzene
Pentachloroethane
Pentachloronitrobenzene
Pentachlorophenol
Phenanthrene
Phenacetin
Phenol
p-Phenylenediamine
Phthalic Anhydride
2-Picoline
Pronamide
1,3-Propane Sultone
n-Propylamine
Propylthiouracil

Pyrene
Pyridine
Resorcinol
Saccharin
Safrole
1,2,3,4-Tetrachlorobenzene
1,2,3,5-Tetrachlorobenzene
1,2,4,5-Tetrachlorobenzene
2,3,4,6-Tetrachlorophenol
o-Toluidine
Thiuram
sym-Trinitrobenzene
tris(1-Azridinyl)phosphine sul
tris(2,3-Dibromopropyl)phospha
2,3,5,6-Tetrachlorophenol
2,3,4,5-Tetrachlorophenol
Thiofanox
1,2,3-Trichlorobenzene
1,2,4-Trichlorobenzene
1,3,5-Trichlorobenzene
2,4,5-Trichlorophenol
2,4,6-Trichlorophenol
Uracil Mustard

ORGANOCHLORINE PESTICIDES AND PCBs

Aldrin
Alpha-BHC
Beta-BHC
Delta-BHC
Gamma-BHC
Chlorobenzilate
Chlordane
4,4'-DDD
4,4'-DDE
4,4'-DDT
Diallate
Dieldrin
Endosulfan I
Endosulfan II
Endosulfan Sulfate
Endrin
Endrin Aldehyde
Endrin Ketone
Heptachlor
Heptachlor Epoxide
Isodrin
Kepone
Methoxychlor
Toxaphene
Aroclor-1016
Aroclor-1221
Aroclor-1232
Aroclor-1242
Aroclor-1248
Aroclor-1254
Aroclor-1260

HERBICIDES

2,4-D
2,4,5-TP
2,4,5-T

ORGANOPHOSPHORUS PESTICIDES

Dimethoate
Disulfoton
Famphur
Methyl Parathion
Parathion
Phorate
Sulfotepp
Thionazin
o,o,o-Triethylphosphorothioate

ALCOHOLS

Acetonitrile; methyl cyanide
1,4-Dioxane
Isobutyl alcohol

DIOXINS

Tetrachlorodibenzodioxin (TCDD)
Pentachlorodibenzodioxin (PeCDD)
Hexachlorodibenzodioxin (HxCDD)
Heptachlorodibenzodioxin (HpCDD)
Octachlorodibenzodioxin (OCDD)
Tetrachlorodibenzofuran (TCDF)
Pentachlorodibenzofuran (PeCDF)
Hexachlorodibenzofuran (HxCDF)
Heptachlorodibenzofuran (HeCDF)
Octachlorodibenzofuran (OCDF)

TABLE D.2

LIST OF ANALYTES/COMPOUNDS ANALYZED FOR BUT NOT DETECTED

INORGANIC ANALYTES

Antimony
Cyanide
Thallium
Tin

RADIONUCLIDES

Americium 241
Antimony 125
Cobalt 60 & 58
Cerium 144
Ruthenium 103 & 106
Cesium 134
Uranium 235
Iodine 129

VOLATILE ORGANICS

Acetonitrile
Acrolein
Acrylonitrile
Allyl Chloride
Benzene
Bromoacetone
Bromoform
Carbon Disulfide
Carbon Tetrachloride
Chlorobenzene
1-Chloro-2,3-epoxypropane
Chlorodibromomethane
2-Chloroethylvinyl ether
Chloroethane
Chloromethyl methyl ether
Chloroprene *
Crotonaldehyde
1,2-Dibromo-3-chloropropane
1,2-Dibromoethane
Dibromomethane
trans-1,4-Dichloro-2-butene
Dichlorobromomethane
Dichlorodifluoromethane *
1,1-Dichloroethane
1,2-Dichloroethane
1,2-Trans-dichloroethylene
1,1-Dichloroethylene
1,3-Dichloropropane
1,2-Dichloropropane
2,3-Dichloropropene
cis-1,3-Dichloropropylene
trans-1,3-Dichloropropylene
1,2,3,4-Diepoxybutane
N,N-Diethylhydrazine
1,4-Dioxane
Ethylbenzene
Ethylcyanide *
Freon TF
Formaldehyde
2-Hexanone
Iodomethane
Isobutyl alcohol
Methyl bromide
Methyl chloride
Methacrylonitrile
Methyl hydrazine
Paraldehyde
Pentachloroethane
Styrene
1,1,1,2-Tetrachloroethane
1,1,2,2-Tetrachloroethane
Tetrachloroethylene
Tetranitromethane
1,1,1-Trichloroethane
1,1,2-Trichloroethane
Trichloromethanethiol
Trichloroethylene
Trichlorofluoromethane
1,1,2-Trichloropropane
1,2,2-Trichloropropane
1,2,3-Trichloropropane
Vinyl Acetate
Vinyl Chloride
Xylene (total)

SEMI-VOLATILE ORGANICS

Acenaphthene
Acenaphthylene
Acetophenone
2-Acetylaminofluorene
Aflatoxins, Total
4-Aminobiphenyl
5-(Aminomethyl)-3-isoxazolol
Aniline *
Anthracene
Aramite *
Auramine **
Benzo(c)acridine
Benzo(a)anthracene
Benzyl Chloride
Benzoic Acid
Benzyl Alcohol
Benzenethiol
Benzo(b)fluranthene
Benzo(j)fluoranthene
Benzo(k)fluoranthene
Benzo(g,h,i)perylene
Benzo(a)pyrene
Benzotrichloride
p-Benzoquinone
bis(2-Chloroethyl)ether
bis(2-Chloroethoxy)methae
bis(2-Chloroisopropyl)ether
4-Bromophenyl-phenylether
Brucine
2-Butanone Peroxide **
Butyl Benzyl Phthalate
2-sec-Butyl-4,6-dinitrophenol
Chloronaphazine **
1-Chloronaphathalene
2-Chloronaphthalene
2-Chlorophenol
4-Chlorophenylphenylether
3-Chloropropionitrile
Chrysene
p-Chloroaniline
p-Chloro-m-cresol
o-Cresol
m-Cresol
p-Cresol
2-Cyclohexyl-4,6-dinitrophenol
Dibenzo(a,h)anthracene
Dibenzo(a,h)acridine
Dibenzo(a,j)acridine
Dibenzo(a,e)pyrene
Dibenzo(a,h)pyrene
Dibenzofuran

Dibenzo(a,i)pyrene
7H-Dibenzo(c,g)carbazole
1,2-Dichlorobenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene
3,3-Dichlorobenzidine *
Dichloromethylbenzene
2,4-Dichlorophenol
2,6-Dichlorophenol
Dichlorophenylarsine **
Diethylphthalate
Dihydrosafrole **
Diisopropylfluorophosphate **
p-Dimethylaminoazobenzene
3,3'-Dimethylbenzidine
7,12-Dimethylbenzo(a)anthcene
1,1-Dimethylhydrazine
1,2-Dimethylhydrazine
a-a-Dimethylphenethylamine
Dimethyl Phthalate
2,4-Dimethylphenol
Di-n-butyl Phthalate
2,4-Dinitrophenol
Dimethyl Sulfate
m-Dinitrobenzene
4,6-Dinotro-o-cresol
2,4-Dinitrotoluene
2,6-Dinitrotoluene
Di-n-octyl Phthalate
Diphenylamine
1,2-Diphenylhydrazine
2,4-Dithiobiuret **
Endothal **
Ethyl Methacrylate
Ethyl Methanesulfonate
Fluoranthene
Fluorene
Formic Acid
Hexachlorobenzene *
Hexachlorobutadiene
Hexachlorocyclopentadiene
Hexachloroethane
Hexachlorophene *
Hexachloropropene *
Hexaethyltetraphosphate **
Hydrazine
Indeno(1,2,3-cd)pyrene

Isophorone
Isosafrole
Maleic Anhydride
Melphalan **
Methyapyrilene
3-Methylcholanthrene
Methyl Methacrylate
4,4-Methylenebis(2-chloroanil
2-Methyllactonitrile
Methyl Methanesulfonate
N-Methyl-N-nitroso-N-nitrogua
2-Methylnaphthalene
Methylthiouracil
Naphthalene
1,4-Naphthoquinoline
1-Naphthylamine
2-Naphthylamine
p-Nitroaniline
m-Nitroaniline
o-Nitroaniline
Nitrobenzene
2-Nitrophenol
4-Nitrophenol
N-Nitrosodi-n-butylamine
N-Nitrosodiethanolamine **
N-Nitrosodiethylamine
N-Nitrosodimethylamine
N-Nitrosomethylethylamine
N-Nitroso-n-methylurethane
N-Nitrosomethylvinylamine
N-Nitrosomorpholine
N-Nitrosonornicotine **
N-Nitrosodi-n-propylamine
N-Nitroquinoline-n-oxide
N-Nitrosospiperidine
N-Nitrosopyrrolidine
N-Nitrosodiphenylamine
N-Nitrososarcosine
5-Nitro-o-toluidine
Octamethylpyrophosphoramide
Paraoxon
Pentachlorobenzene
Pentachloroethane
Pentachloronitrobenzene
Pentachlorophenol
Phenanthrene
Phenacetin

Phenol
p-Phenylenediamine
Phthalic Anhydride
2-Picoline *
Pronamide
1,3-Propane Sultone **
n-Propylamine
Propylthiouracil
Pyrene
Pyridine *
Resorcinol
Saccharin
Safrole
1,2,3,4-Tetrachlorobenzene
1,2,3,5-Tetrachlorobenzene
1,2,4,5-Tetrachlorobenzene
2,3,4,6-Tetrachlorophenol
o-Toluidine
Thiuram
sym-Trinitrobenzene
tris(1-Azridinyl)phosphine sul
**
tris(2,3-Dibromopropyl)phospha
2,3,5,6-Tetrachlorophenol
2,3,4,5-Tetrachlorophenol
Thiofanox
1,2,3-Trichlorobenzene
1,2,4-Trichlorobenzene
1,3,5-Trichlorobenzene
2,4,5-Trichlorophenol
2,4,6-Trichlorophenol
Uracil Mustard **

ORGANOCHLORINE PESTICIDES AND PCBs

Aldrin
Alpha-BHC
Beta-BHC
Delta-BHC
Gamma-BHC
Chlorobenzilate
Chlordane
4,4'-DDD
4,4'-DDE
4,4'-DDT
Diallate

Table D.2 Continued

Dieldrin
Endosulfan I
Endosulfan II
Endosulfan Sulfate
Endrin
Endrin Aldehyde
Endrin Ketone
Heptachlor
Heptachlor Epoxide
Isodrin
Kepone *
Methoxychlor
Toxaphene
Aroclor-1016
Aroclor-1221
Aroclor-1232
Aroclor-1242
Aroclor-1248
Aroclor-1254
Aroclor-1260

HERBICIDES

2,4-D
2,4,5-TP
2,4,5-T

ORGANOPHOSPHORUS PESTICIDES

Dimethoate
Disulfoton
Famphur
Methyl Parathion
Parathion
Phorate
Sulfotepp
Thionazin
o,o,o-Triethylphosphorothioate

ALCOHOLS

Acetonitrile; methyl cyanide
1,4-Dioxane
Isobutyl alcohol

DIOXINS

Tetrachlorodibenzodioxin (TCDD)
Pentachlorodibenzodioxin (PeCDD)
Hexachlorodibenzodioxin (HxCDD)
Heptachlorobenzodioxin (HpCDD)
Octachlorodibenzodioxin (OCDD)
Tetrachlorodibenzofuran (TCDF)
Pentachlorodibenzofuran (PeCFD)
Hexachlorodibenzofuran (HxCDF)
Heptachlorodibenzofuran (HpCDF)
Octachlorodibenzofuran (OCDF)

* Compounds were analyzed by performing an NBS spectral library search. Reference standards were not available.

** Compound could not be analyzed for as no reference standard was available nor reference spectra present in the NBS spectral library.